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(54) **ATTACHING MULTIPLE PHONE LINES TO A SINGLE MOBILE OR LANDLINE PHONE**

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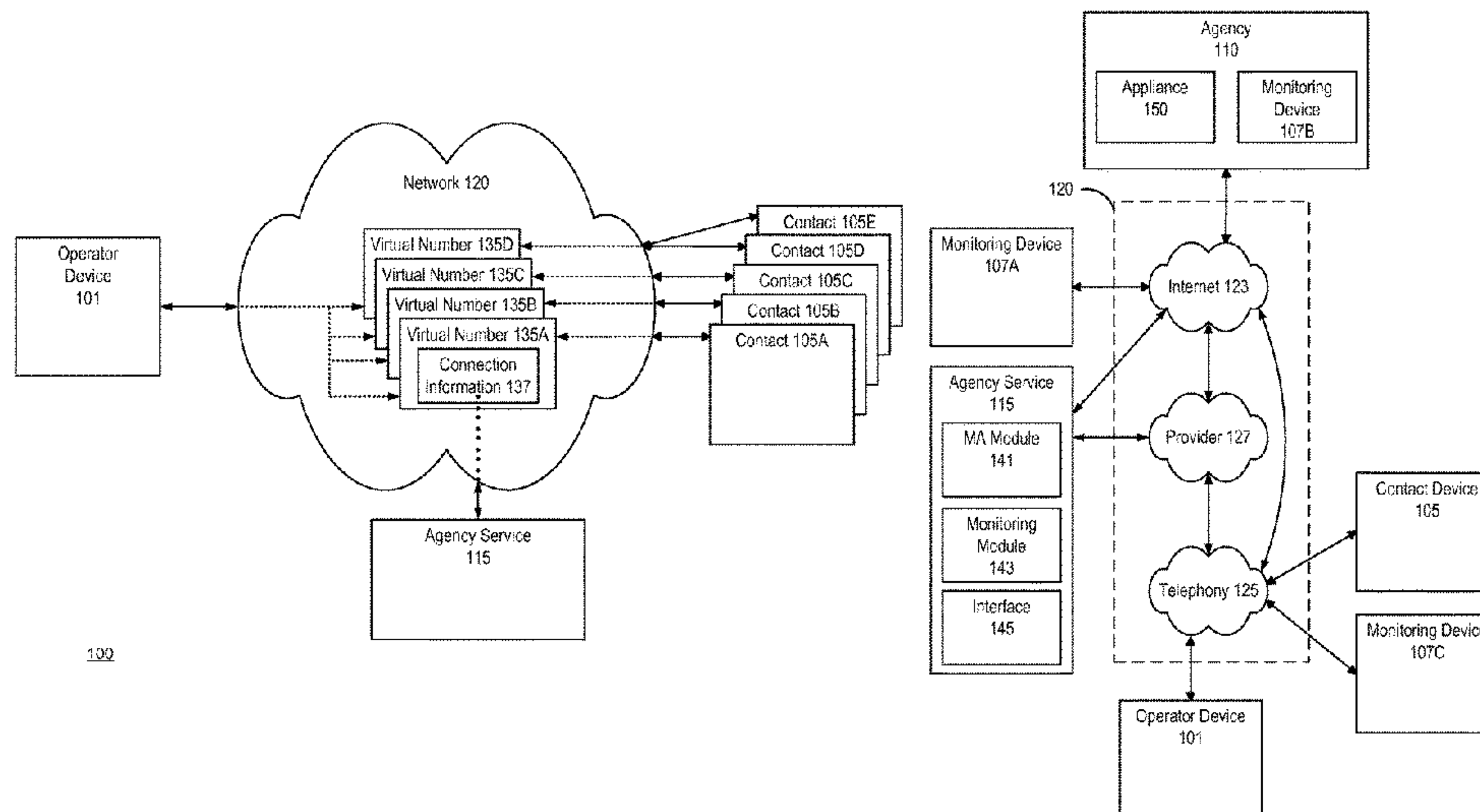
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(57) **ABSTRACT**

Agencies issue multiple devices to personnel for maintaining distinct identities over the course of assigned investigations. To provide flexible capabilities to agencies, a phone is converted for use with multiple attached telephone numbers. Accordingly, a single phone may be used to manage multiple identities over the course of one or more investigations. Using a multiple attached number, a given device can place and receive calls over the network to and from contacts. In addition to providing multiple attached numbers, calls using the multiple attached numbers may be monitored live and recorded to establish evidence.

23 Claims, 11 Drawing Sheets



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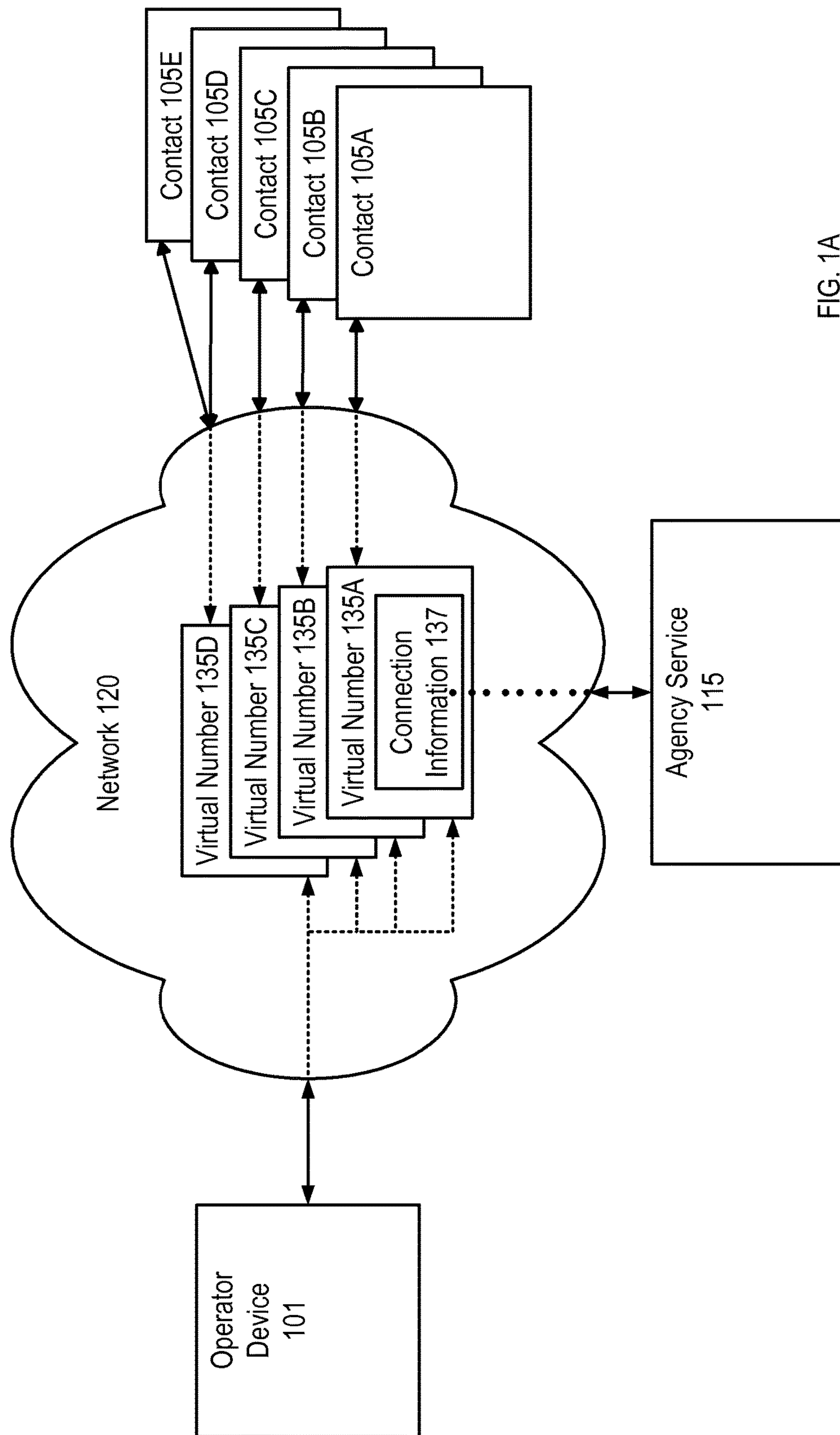


FIG. 1A

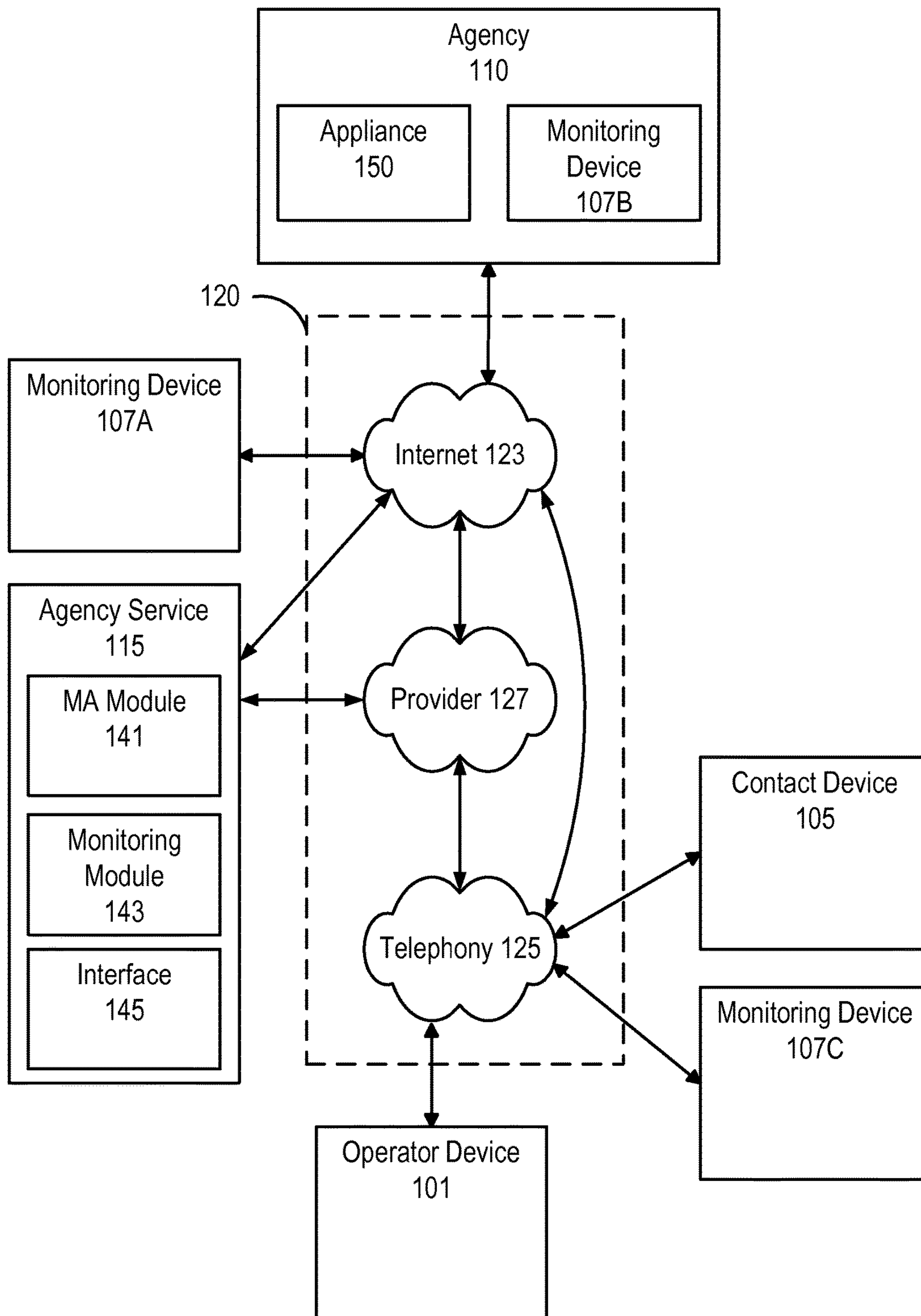


FIG. 1B

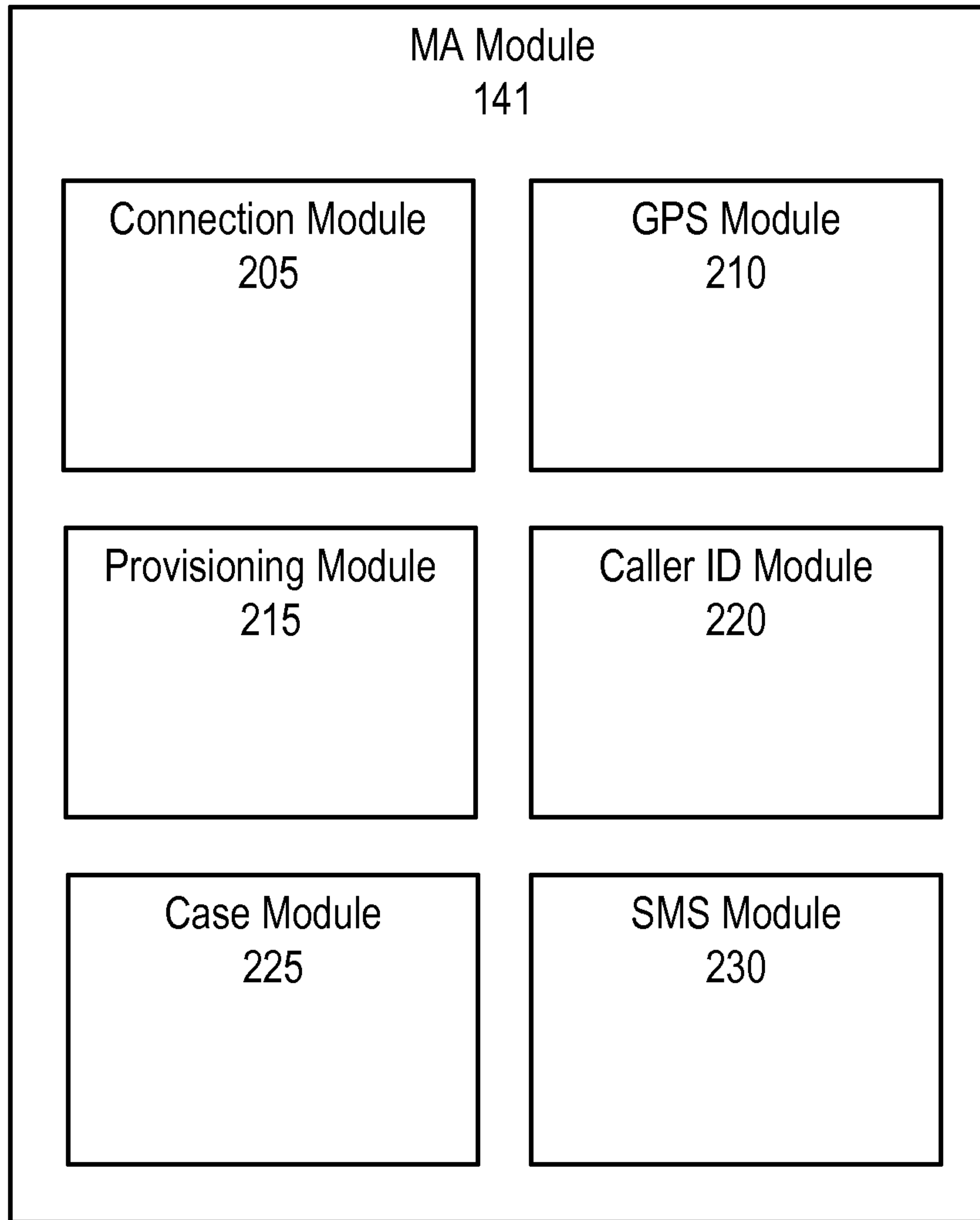


FIG. 2

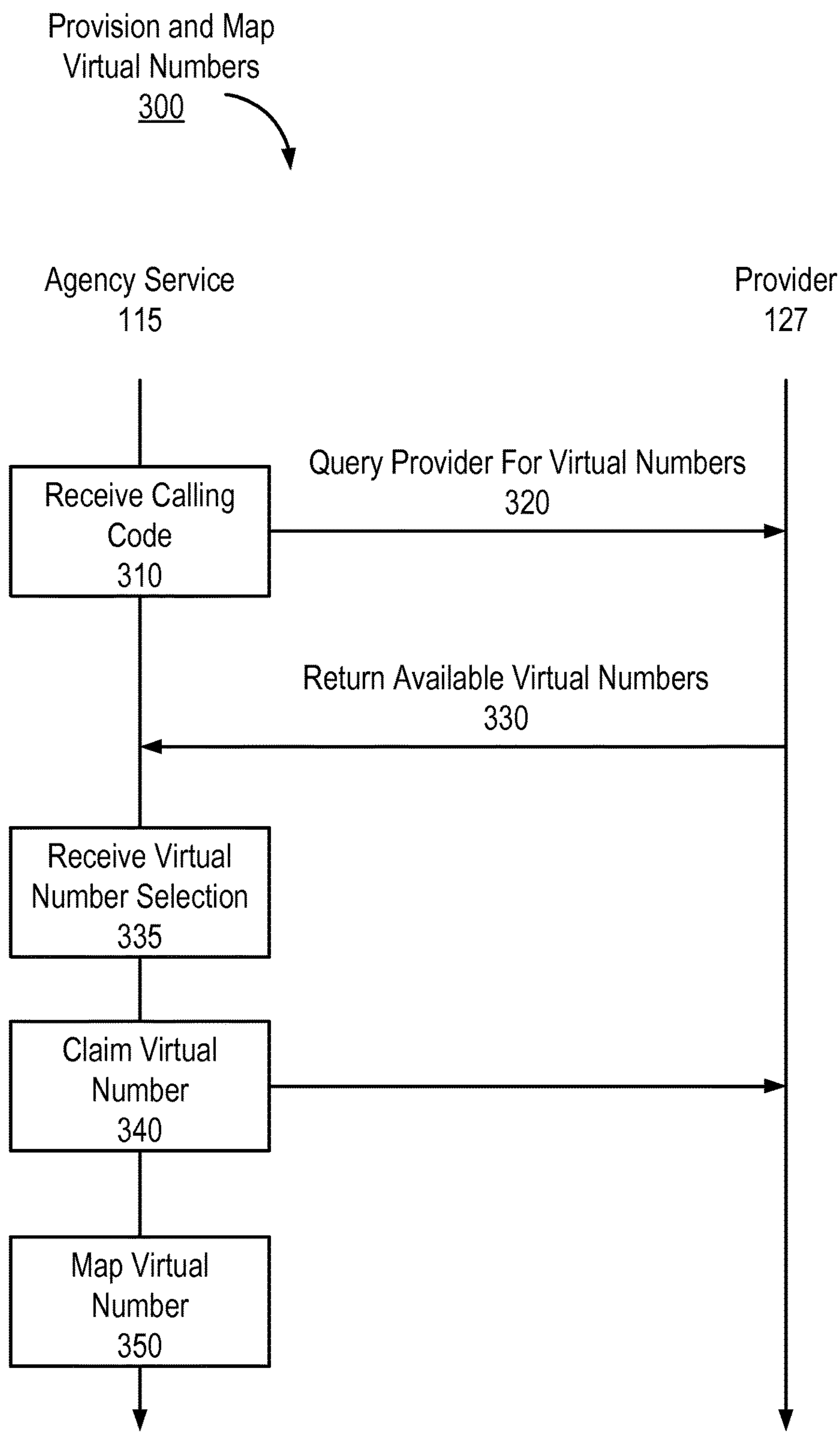


FIG. 3A

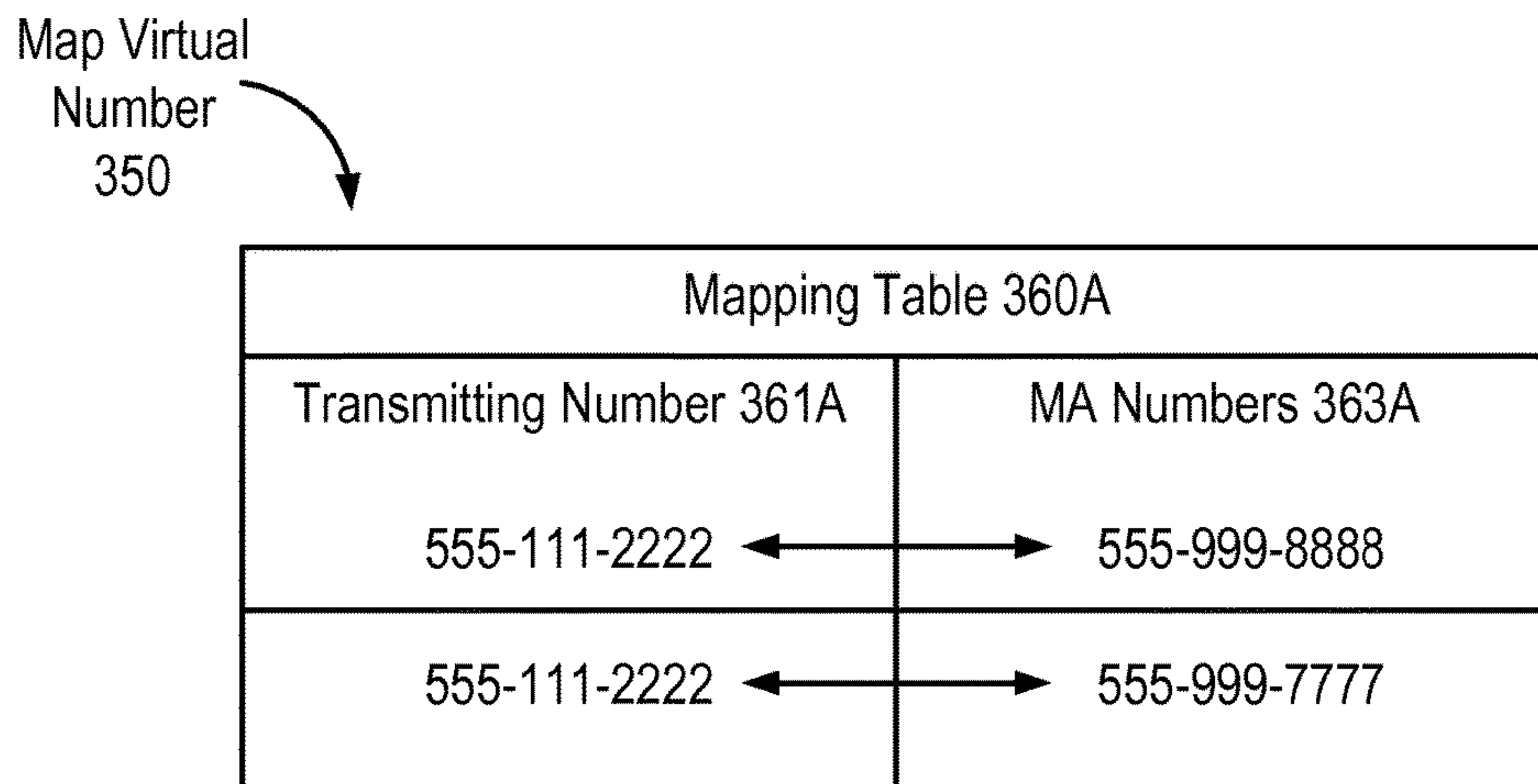


FIG. 3B

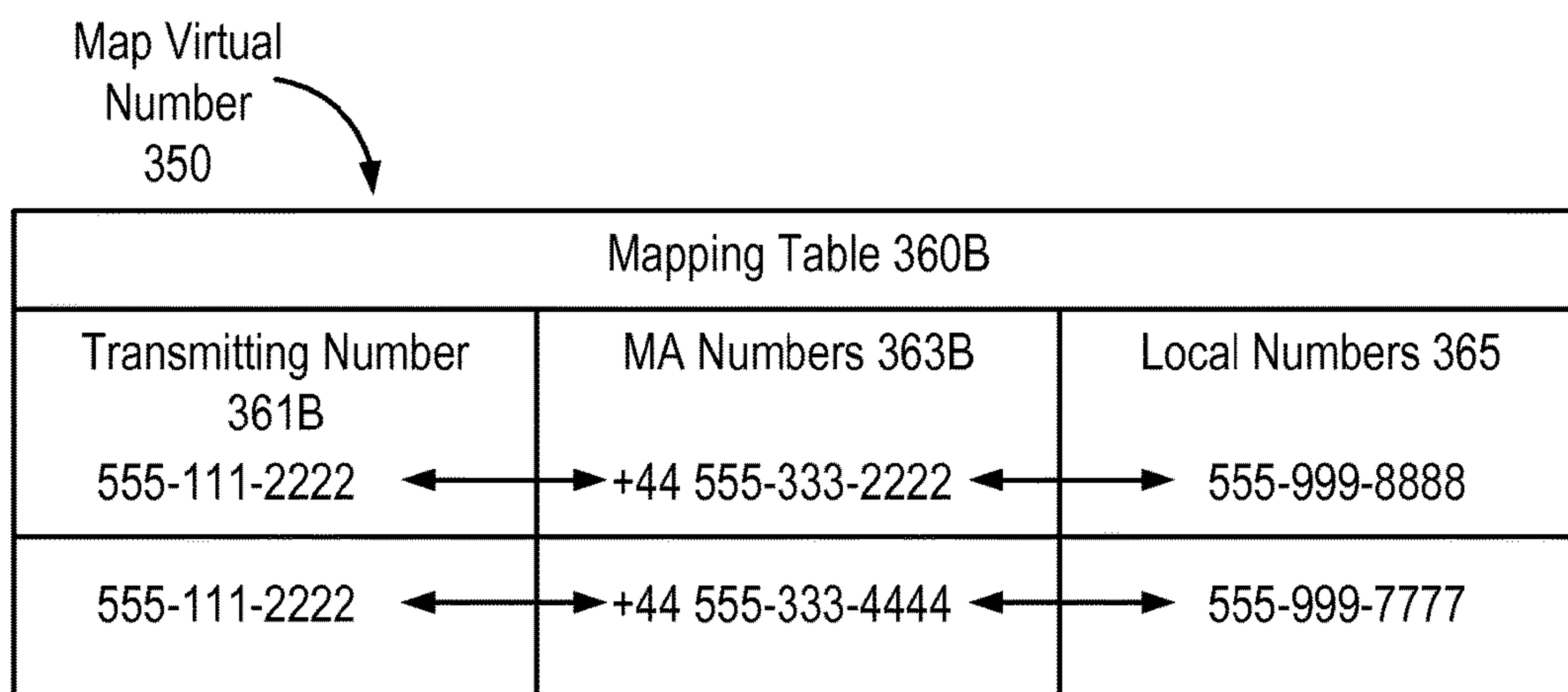


FIG. 3C

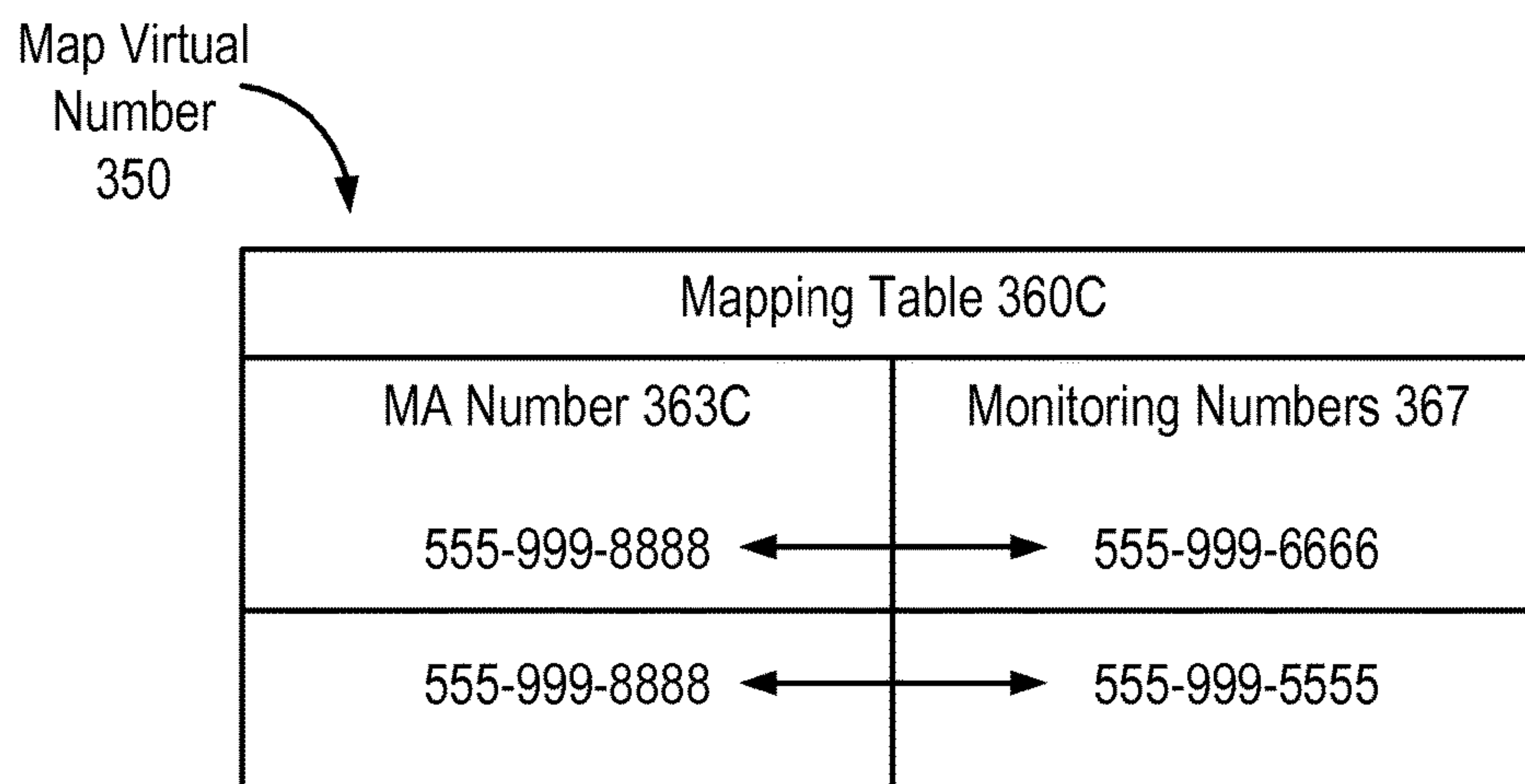


FIG. 3D

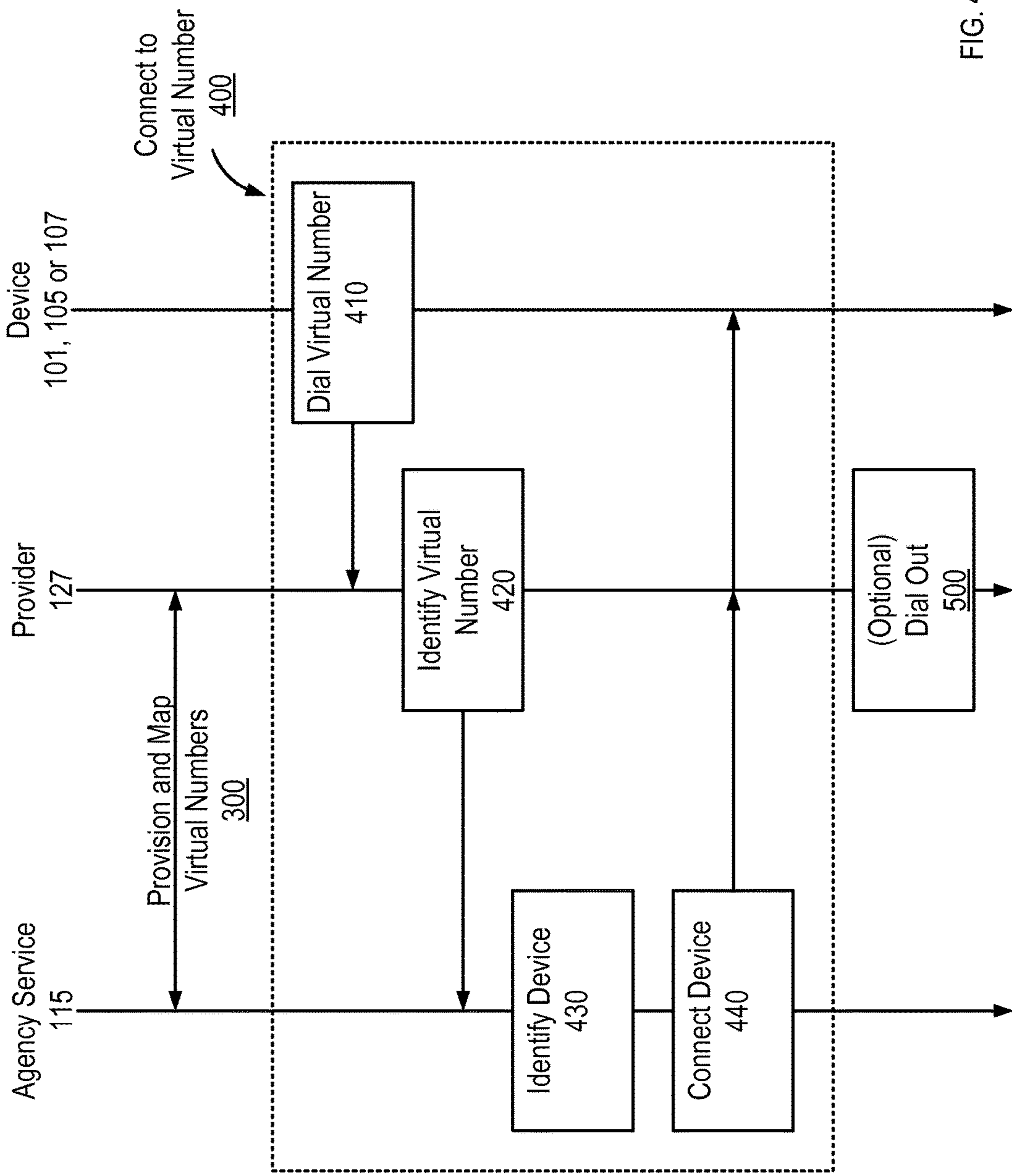


FIG. 4

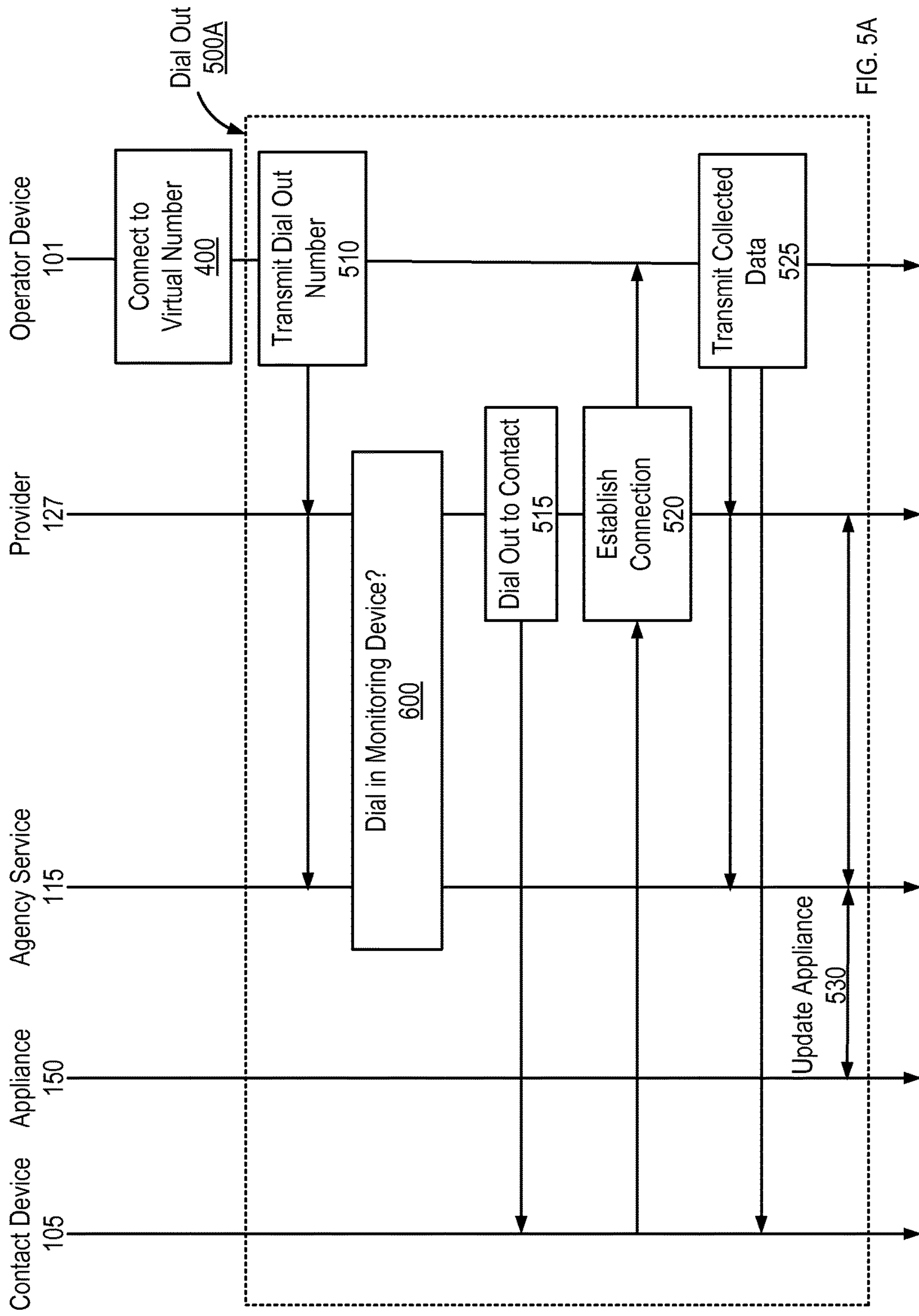
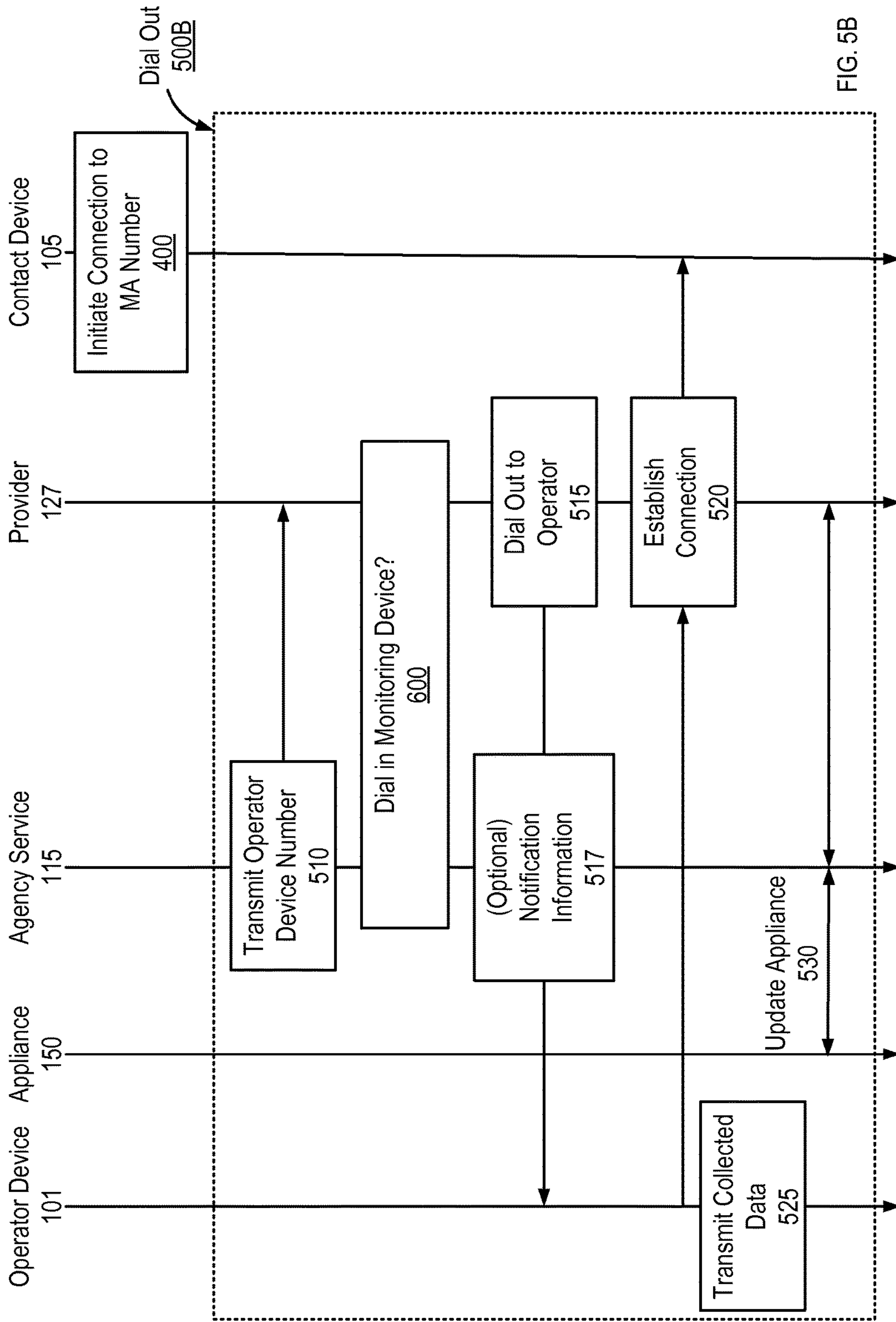


FIG. 5A



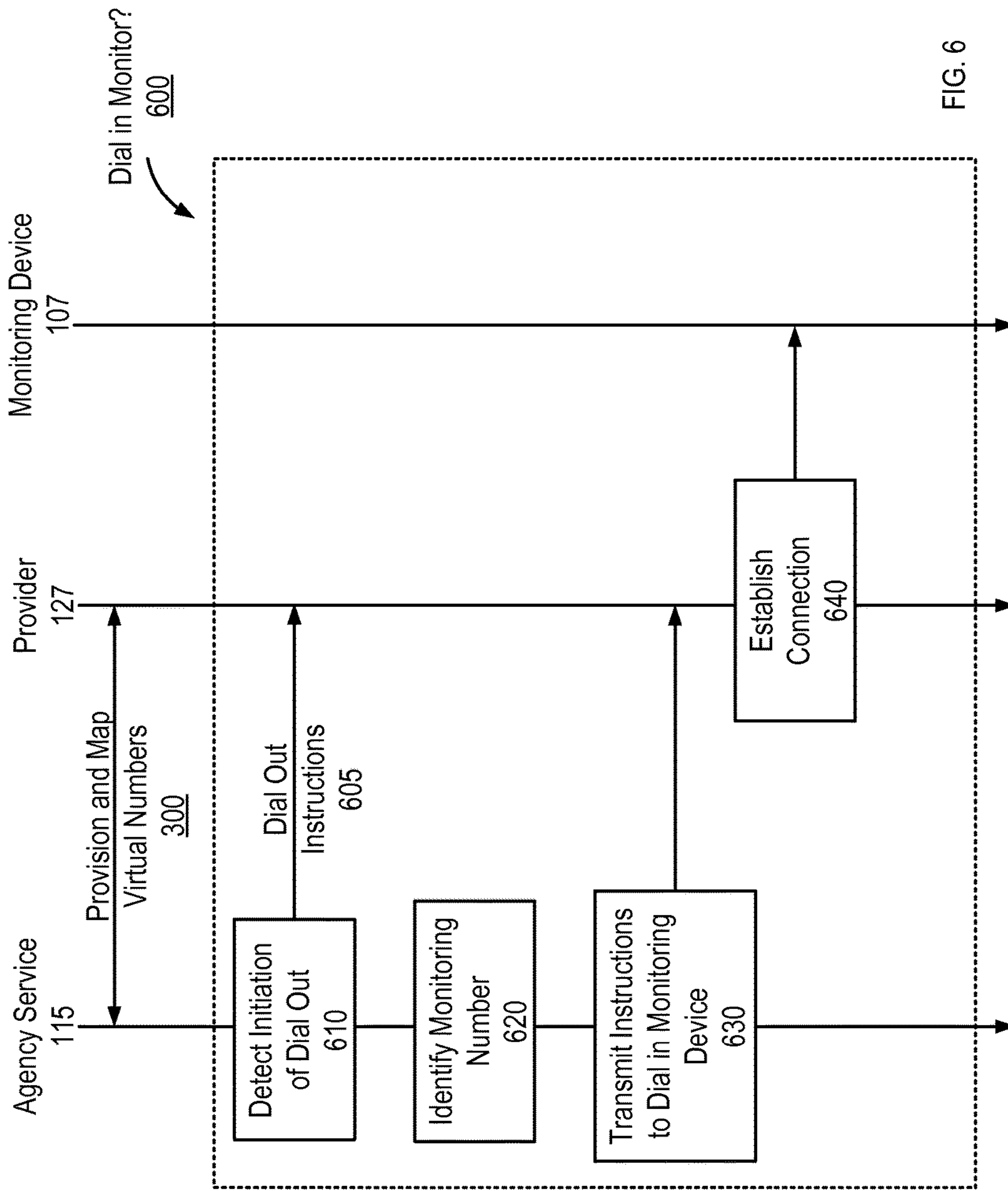


FIG. 6

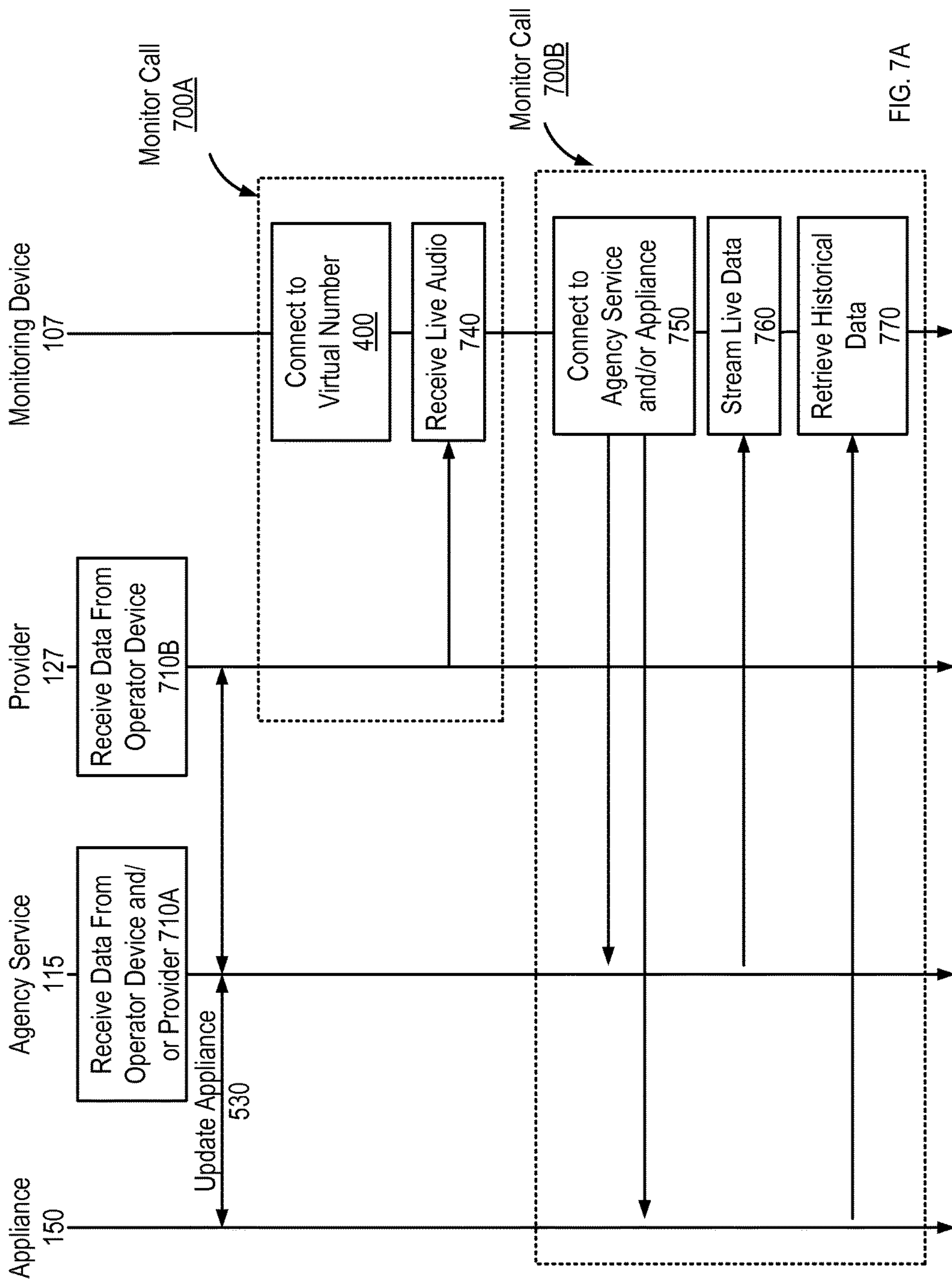


FIG. 7A

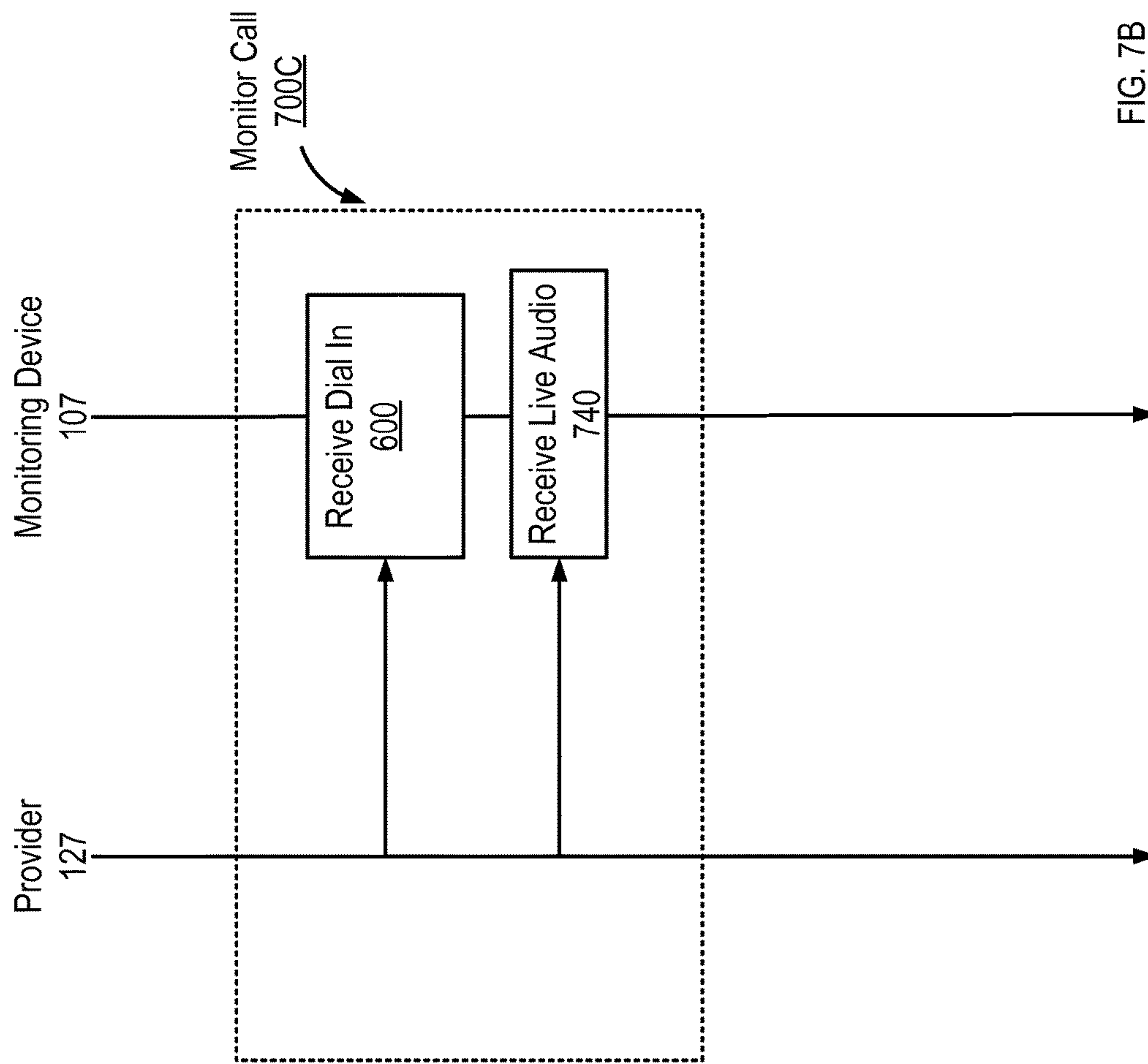


FIG. 7B

ATTACHING MULTIPLE PHONE LINES TO A SINGLE MOBILE OR LANDLINE PHONE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation in part of U.S. application Ser. No. 13/539,050, filed Jun. 29, 2012, which claims the benefit of U.S. Provisional Application 61/503,586, filed Jun. 30, 2011, both of which are incorporated by reference herein in their entirety.

BACKGROUND

1. Field of Art

The present disclosure generally relates to the field of undercover operations and more specifically to managing multiple identities using a single phone.

2. Background of the Invention

Police officers and other agents “operators” oftentimes conduct multiple investigations at the same time during the course of their duties. In many cases, these investigations require the operator to use phones to call, send short message service “SMS” messages (including multimedia messaging service “MMS” messages and proprietary messaging services such as BLACKBERRY messages “BBM”), or otherwise communicate with various contacts under a fake identity. Oftentimes, criminals and other individuals can ascertain information about the operator or the device used by the operator from data associated with the communication. Accordingly, operators frequently use multiple telephonic devices to manage different contacts and protect their identity.

Many operators are issued multiple mobile phones by their agency or department for use with different contacts and for different investigations. For example, the operator may require different phones having different numbers when communicating with different contacts in order to maintain a specific identity or conceal their true identity. Traditionally, the operator would physically require multiple phones or multiple subscriber identity modules (SIM cards) to maintain these different identities.

Use of multiple physical phones present difficulties for the operator in that the operator must carry the correct phone and/or multiple phones at the right time to receive a call or otherwise use the device. Multiple SIM cards are similarly intrusive in that, while they contain all the information required for a given identity, the operator would not receive notifications of calls, etc., incoming to a SIM card unless it was active in a device. Hence, the operator would still require multiple phones to monitor activity on multiple SIM cards. Furthermore, agencies oftentimes lack the ability to issue operators the appropriate devices, SIMs and/or corresponding identities in real time. While these difficulties are discussed with respect to an operator, private individuals (e.g., a business owner) and other entities face similar difficulties when operating multiple devices.

SUMMARY

The above and other issues are address by a method and computer system for configuring one or more virtual numbers for use on a network and attaching the virtual numbers to the operator device. An embodiment of the method comprises receiving connection information in response to requests, such as a phone call or a message, from a telephonic device to communicate with a virtual number. The

connection information includes device information about the telephonic device and the virtual number. Based on the connection information, the telephonic device is identified as a contact device or operator device from a mapping table that stores device information associated with virtual number information.

If the mapping table identifies the telephonic device requesting to connect to the virtual number as an operator device, the method further comprises receiving device information corresponding to a contact device the operator would like to communicate with and transmitting instructions for at least one of connecting the operator device with the contact device through the virtual number or transmitting data received from the operator device to the contact device from the virtual number.

If the mapping table identifies the telephonic device requesting to connect to the virtual number as a contact device, the method further comprises transmitting instructions for establishing a connection between the contact device and the operator device. As the contact device and the operator device communicate using the virtual number, contacts are prevented from ascertaining device and/or number information associated with the operator device.

The method may further comprise receiving number information for configuring the virtual number to playback a specified ring tone when the telephonic device requests to communicate with the virtual number. If the mapping table identifies the telephonic device requesting to connect to the virtual number as a contact device, the method further comprises continuing to play the specified ring tone for the contact device until the connection between the contact device and the operator device is established. The specified ring tone spoofs the physical location of the operator device.

The method may further comprise identifying a monitoring device associated with the virtual number based on the mapping table. In response to identifying the monitoring device, the method further comprises transmitting instructions for establishing a second connection with the monitoring device, the second connection configured to provide the monitoring device with audio communications between the contact device and the operator device. The second connection may also be configured to prevent the contact device and the monitoring device from receiving audio from the monitoring device for the duration of the second connection.

An embodiment of the system comprises a service having one or more processors and a non-transitory computer-readable storage medium storing computer program code. When executed, the computer program code causes the server to receive information in response to requests, such as a phone call or a message, from a telephonic device to communicate with a virtual number. The information received includes device information about the telephonic device and the virtual number. Based on the connection information, the server identifies the telephonic device as a contact device or operator device in response to matching received information with device information associated with virtual number information stored in a mapping table.

If the mapping table identifies the telephonic device requesting to connect to the virtual number as an operator device, the server receives device information corresponding to a contact device the operator would like to communicate with and, in turn, transmits instructions for at least one of connecting the operator device with the contact device through the virtual number or transmitting data received from the operator device to the contact device from the virtual number.

If the mapping table identifies the telephonic device requesting to connect to the virtual number as a contact device, the server transmits instructions for establishing a connection between the contact device and the operator device. As the contact device and the operator device communicate through the virtual number, contacts are prevented from ascertaining device and/or number information associated with the operator device.

The server may further receive number information for configuring the virtual number to playback a specified ring tone when the telephonic device requests to communicate with the virtual number. If the mapping table identifies the telephonic device requesting to connect to the virtual number as a contact device, the system may further transmit instructions for continuing to play the specified ring tone for the contact device until the connection between the contact device and the operator device is established. The specified ring tone spoofs the physical location of the operator device.

The server may further identify a monitoring device associated with the virtual number based on the mapping table. In response to identifying the monitoring device, the server may further transmit instructions for establishing a second connection with the monitoring device, the second connection configured to provide the monitoring device with audio communications between the contact device and the operator device. The second connection may also be configured to prevent the contact device and the monitoring device from receiving audio from the monitoring device for the duration of the second connection.

Additionally, multiple virtual numbers may be attached, or associated with, a single operator device to allow an operator to manage a variety of contacts. In turn, embodiments may further comprise receiving a selection of which virtual number to use for communicating with a specified contact device without compromising operator identity.

BRIEF DESCRIPTION OF THE DRAWINGS

The teachings of the embodiments can be readily understood by considering the following detailed description in conjunction with the accompanying drawings.

FIG. 1A is a block diagram illustrating an environment for implementing a multiple attached number "MA number" system according to one example embodiment.

FIG. 1B is a block diagram illustrating an operating environment of an agency service providing MA numbers according to one example embodiment.

FIG. 2 is a block diagram illustrating a MA module according to one example embodiment.

FIG. 3A is an interaction diagram illustrating a method for provisioning and mapping virtual numbers for operating an operator device with MA numbers according to one example embodiment.

FIGS. 3B and 3C are tables illustrating example embodiments of virtual number mapping for operating and monitoring MA numbers.

FIG. 3D is a table illustrating an example embodiment of virtual number mapping for automatically notifying a monitoring device.

FIG. 4 is an interaction diagram illustrating a method for connecting an operator device and contact device using a virtual number according to one example embodiment.

FIG. 5A is an interaction diagram illustrating a method for dialing out to a contact device using a MA number, according to one example embodiment.

FIG. 5B is an interaction diagram illustrating a method for dialing out to an operator device using a MA number, according to one example embodiment.

FIG. 6 is an interaction diagram illustrating a method for dialing in a monitoring device to monitor an operator device according to one example embodiment.

FIGS. 7A and 7B are example interaction diagrams illustrating methods for monitoring an operator device according to an embodiment.

DETAILED DESCRIPTION

The Figures (FIG.) and the following description relate to preferred embodiments by way of illustration only. It should be noted that from the following discussion, alternative embodiments of the structures and methods disclosed herein will be readily recognized as viable alternatives that may be employed without departing from the principles of the embodiments.

Reference will now be made in detail to several embodiments, examples of which are illustrated in the accompanying figures. It is noted that wherever practicable, similar or like reference numbers may be used in the figures and may indicate similar or like functionality. The figures depict embodiments for purposes of illustration only.

Overview

Many operators possess a personal mobile phone or are issued a mobile phone by their agency or department. Oftentimes, operators work multiple cases and the traditional procedure of issuing/carrying additional devices or SIMs is not feasible under the given circumstances or simply cumbersome to the operator or agency. Furthermore, the traditional procedure requires the operator to manually manage the collection of devices, SIMs and their associated identities. In high pressure situations, the operator may inadvertently compromise an identity or lack the appropriately configured device. Accordingly, the agency may coordinate with an agency support service for configuring the operator's mobile phone or landline phone to fulfill the role of multiple telephonic devices. The configuration can take place over-the-air such that a given phone is conveniently converted as needed. Additionally, if the agency desires to provide the capabilities of multiple telephonic devices to additional operators, the agency can specify additional phones for configuration.

Example embodiments described herein relate to implementing a multiple attached "MA" number system over a wired and wireless radio network (e.g., PSTN, Cellular Network and/or WiFi) for network capable devices, such as a mobile phone, or a land-line phone for use with multiple attached numbers "MA numbers". As mobile phones and similar devices are commonly carried by operators during the course of undercover investigations, mobile phones offer an existing platform for transmitting data wirelessly. Use of such a device with MA numbers allows operators to utilize a single operator device, but maintain numerous, distinct telephonic identities for communicating with various contacts. Operators working from a fixed location with a landline phone are also provided similar capabilities for using MA numbers.

Additionally, with the popularity of smart phones and feature phones, additional monitoring and safety features may be integrated into the operator's device for enhancing operational viability in the field. For example, the operator device may be configured to collect a wide range of valuable

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real-time data. Real-time data collected by the operator device may include audio and Global Positioning System (“GPS”) coordinates, etc.

The operator device may subsequently transmit all or a portion of the collected real-time data over existing channels (e.g., a network) back to the agency, agency service or another entity, such as those monitoring the operator’s activities using a MA number. For example, embodiments of the agency, agency service and/or other entities within the MA number system receive the collected data for storage and/or live streaming to monitoring devices, operator devices and records. Depending on the embodiment, the monitoring devices are further configured to access and present (e.g., play and/or display) a variety of the real-time and historical data stored on or streamed by the entities on the network. For example, the monitoring devices may access a web interface, API or execute a standalone application for viewing operator device and MA number details and collected information. In some embodiments, the monitoring devices may access portions of the real-time data via a provided monitoring line associated with the MA number and configured for maintaining the operator’s cover. The monitoring line may be used to provide call audio to monitoring devices. Alternatively, the mentoring device may be connected to the MA number, but with outbound audio communications from the monitoring device disabled. Thus, the monitor may be provided with call audio while the operator’s cover is maintained. Furthermore, other agencies with appropriate credentials and monitoring devices may similarly access portions of the collected information during inter-agency investigations.

Environment and Implementation of the Operator Device System

FIG. 1A is a block diagram illustrating an environment **100** for implementing a multiple attached number system according to one example embodiment. As shown the environment **100** includes a network **120** connecting an agency support service provider “agency service” **115**, an operator device **101** and contact devices **105A** through **105E**. While only one agency service **115** and one operator device **101** are shown in FIG. 1A for clarity, embodiments can support many operator devices **101** and have multiple agency service providers **115**.

Agency service **115** represents a collection of compute devices (e.g., servers) and related storage mediums that are configured for performing various activities such as configuring operator devices **101**, exchanging data over the network **120** and storing data in support of one or more agencies (not shown) and operated operator devices **101**. For example, the agency service **115** may include one or more modules providing ascribed functionality to an agency via an application programming interface (“API”) or web interface, collectively “the interface”, as described in more detail with reference to FIG. 1B. The agency service **115** may also include infrastructure for providing audio and video communicability (e.g., internally and/or over the network **120**) within the monitoring interface using the public switched telephone network (“PSTN”), voice over internet protocol (“VoIP”) and video conferencing services.

The operator devices **101** are oftentimes mobile telephonic devices capable of collecting data and transmitting data (e.g., wirelessly) over the network **120**. Some examples of an operator device **101** include a mobile phone, tablet or notebook computer. Example embodiments of the operator device **101** as a mobile phone include feature phones, smart phones or standard mobile phones. Accordingly, a given mobile phone or other device operated as an operator device

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101 may not necessarily include or support all of the functionality ascribed herein to the operator device or MA number system due to inherent differences in device capabilities. In some embodiments, other telephonic devices such as land-line phones are used with the MA number system.

In one embodiment, the operator device **101** executes a MA module for automating connections through the network **120** and collecting and transmitting data to entities on the network **120**. An example embodiment of a MA module is described in more detail with reference to FIG. 2.

In addition to the operator devices **101**, a number of monitoring devices (not shown) may connect to entities on the network **120** to obtain or present data associated with one or more of the operator devices. Depending on the embodiment, a monitoring device is a network **120** capable device that can be operated within an agency or externally in the field. As referred to herein, a monitoring device is a mobile or stationary device capable of connectivity (e.g., wireless or wired) to a network **120** such as an agency network, the internet, PSTN and/or cellular network. Some examples of a monitoring device include a mobile phone, land-line phone, tablet and notebook or desktop computer.

Example embodiments of the monitoring device as a mobile phone can include feature phones, smart phones or standard mobile phones. Accordingly, a given mobile phone or other device operated as a monitoring device does not necessarily include or support all of the functionality ascribed herein to the monitoring device or the MA number system due to inherent differences in device capabilities. In one example embodiment, the monitoring device executes a monitoring module for interfacing with entities on the network **120** to manage operator devices **101** and view collected data.

Also shown are a number of contact devices **105** associated with contacts the operator desires to communicate with using a desired identity. Embodiments of the various contact devices **105** include any network **120** capable device that may send or receive information associated with a transmitting number on the network **120** (however, in some instances, the contact device **105** may use a virtual number itself, or other means, to do so). Accordingly, as referred to herein, a contact device **105** is a mobile or stationary device capable of connectivity (e.g., wireless or wired) to the network **120** for sending or receiving information over the internet, PSTN and/or cellular network. Some examples of a contact device **105** include a mobile phone, land-line phone, tablet and notebook or desktop computer.

FIG. 1A also illustrates a number of virtual numbers **135A** through **135D** configured for use on the network **120**. In one embodiment, the agency service **115** provisions and configures the virtual numbers **135** and handles number information to establish identities for the virtual numbers on the network **120**. Additionally, the agency service **115** receives connection information **137** describing operator devices **101** and contact devices **105** requesting to communicate with handled virtual numbers **135**. For example, an operator device **101** or contact device **105** may request (and attempt) to communicate with a virtual number (e.g., **135A**) by way of a connection request or otherwise transmitting data to the virtual number. Common examples of communication requests include placing a call to and/or messaging the virtual number from a given device. Based on the device information and configuration of the virtual number, the agency service **115** identifies devices requesting to communicate with a virtual number as either the operator device **101** associated with the virtual number or a contact device **105** (and, in some cases, a monitoring device). For example,

the agency service **115** may maintain a mapping table storing transmitting numbers and authentication information for a given operator device **101** and attached virtual numbers **135** for identifying the operator device based on the connection information **127**.

When the operator device **101** requests to communicate with the virtual number **135A**, the agency service **115** identifies the transmitting number of the device as that of the operator device **101** using the mapping table. After identifying the operator device **101**, the agency service **115** enables the operator device **101** to specify a given contact **105A** the operator would like to communicate with and, in turn, enables the operator device **101** to communicate with the contact device **105A** through (e.g., establishing a connection with or transmitting data from) the virtual number. For example, the operator device **101** specifies device information, such as a transmitting number, for the contact device **105A**. The agency service **115** receives the device information for the contact device **105A** and transmits instructions that cause the contact device to receive a call from virtual number **135A**. If the contact device **105A** answers, the parties are connected.

In another example, the operator device **101** may transmit data such as an SMS message to the virtual number **135A** and specify a contact device **105A** for receiving the SMS message from the virtual number **135A**. In other words, the agency service **115** transmits instructions (e.g., to a provider) to dial out to the contact device **105A** from the virtual number **135A** to connect the operator device **101** with the contact device **105** or to send an SMS message from the virtual number to transmit data received from the operator device **101** to intended the contact. As the agency service **115** connects the operator device **101** with entities on the network **120** through the virtual number, the virtual numbers **135** prevent other entities, such as contacts **105**, from viewing device and/or number information associated with the operator device.

When the contact device **105A** requests to communicate with the virtual number **135A**, the agency service **115** determines that the transmitting number of the device is not that of the operator device **101** using the mapping table. Thus, the agency service **115** identifies the contact device **105A** as attempting to communicate with the operator using the virtual number. The agency service **115** determines the operator device (e.g., operator device **101**) associated with the virtual number **135A** and in turn, enables the operator device **101** to receive communications from the contact device **105A** through the virtual number **135A**. For example, the agency service **115** may transmit instructions for connecting the contact device **105** with the operator device **101** (e.g., by dialing out to the operator device **101**, optionally from the virtual number) or transmitting data such as SMS messages received at the virtual number from the contact device to the operator device from the virtual number or directly from the agency service **115**. As the contact devices **105** send and receive communications to/from the operator device **101** through the virtual number, contacts are typically unable to ascertain device and/or number information associated with the operator device.

The operator device **105**, on the other hand, may receive the connection information **137** from the agency service **115** or other entity about contact devices **105** dialing a virtual number **135** and the number identity of the dialed virtual number. Accordingly, the operator may make an informed decision about the caller and the identity expected from the operator. The agency service **115** may further enable the operator or agency to configure multiple virtual numbers to

attach to, or associated with, a single operator device **101** for managing a variety of contacts **105**. In turn, the operator may use the single operator device **101** to select which virtual number (e.g., **135A**) to use for connecting to a specified contact device **105A** over the network **120** without compromising operator identity.

As described above, the agency service **115** provisions and configures virtual numbers **135** and handles number information to establish identities for the virtual numbers on the network **120**. In some embodiments, the agency service **115** may additionally specify one or more monitoring devices (not shown) to notify when the operator device **101** or contact device **105** utilizes a virtual number **135A** for communications. For example, the agency service **115** may maintain a mapping table storing transmitting numbers and authentication information for monitoring devices in associated with the virtual number **135A**. When the agency service **115** identifies an operator device **101** requesting to communicate using the virtual number **135A** or a contact device **105** attempting to connect to the virtual number **135A**, the agency service **115** connects the parties while additionally notifying the monitoring device. The notifications themselves may come in different forms and are explained in more detail below.

In the case telephonic communications between the contact device **105** and the operator device **101**, the agency service **115** identifies instances when the operator device **101** and the contact device **105** attempt to establish telephonic communications through the virtual number **135A**. In turn, the agency service **115** may transmit instructions (e.g., to a provider) to dial out to the monitoring device and connect the monitoring device with the virtual number **135A**. When connected to the virtual number **135**, the monitoring device receives the audio data corresponding to communication between the contact device **105** and operator device **101** through the virtual number **135**. In order to prevent contact suspicion as to the operator's identity, audio transmissions from the monitoring device to the virtual number and any audio associated with establishing the connecting between the monitoring device and the virtual number is disabled.

In the case of SMS communications between the operator device **101** and contact device **105**, the agency service **115** identifies the sender, intended recipient and the virtual number **135A** used. In turn, the agency service **115** may transmit instructions to append the SMS message with the identity of the sender, recipient and/or virtual number. The SMS messages may then be forwarded to monitoring devices associated with the virtual number (e.g., in the mapping table) and capable of receiving SMS messages. The virtual number **135A** used may be omitted from the SMS message when the virtual number **135A** is utilized to transmit the SMS message to the monitor device. Alternatively, the agency service **115** may retrieve the SMS message (e.g., from a provider or the operator device) and provide the messages to the monitoring device in another fashion, such as via email or an online interface.

The network **120** represents the communication pathway between agencies, agency service **115**, the operator devices **101**, contact devices **105**, monitoring devices and other entities (not shown). In one embodiment, the network **120** includes standard communications technologies and/or protocols and can include the Internet and PSTN. Oftentimes, these communications technologies and/or protocols carry both PSTN and Internet related data. Thus, the network **120** can include links using technologies such as Ethernet, 802.11, worldwide interoperability for microwave access

(WiMAX), 2G/3G/4G mobile communications protocols, worldwide interoperability for PSTN communications, digital subscriber line (DSL), asynchronous transfer mode (ATM), InfiniBand, PCI Express Advanced Switching, etc. Similarly, the networking protocols used on the network **120** can include multiprotocol label switching (MPLS), the transmission control protocol/Internet protocol (TCP/IP), the User Datagram Protocol (UDP), the hypertext transport protocol (HTTP), the simple mail transfer protocol (SMTP), the file transfer protocol (FTP), etc. The data exchanged over the network **120** can be represented using technologies and/or formats including analog audio (e.g., for last mile PSTN communications), digital audio and video (e.g., as a file or streaming with Real Time Streaming Protocol), the hypertext markup language (HTML), the extensible markup language (XML), JavaScript, VBScript, FLASH, the portable document format (PDF), etc. In addition, all or some of the data exchanged over the network **120** can be encrypted using conventional encryption technologies such as secure sockets layer (SSL), transport layer security (TLS), virtual private networks (VPNs), Internet Protocol security (IPsec), etc. In another embodiment, the entities on the network **120** can use custom and/or dedicated data communications technologies instead of, or in addition to, the ones described above. For example, some government agencies and the military may operate networks auxiliary to the internet and PSTN.

As used herein, the term “module” refers to computer program instructions and/or other logic used to provide the specified functionality. Thus, a module can be implemented in hardware, firmware, and/or software. In one embodiment, program modules formed of executable computer program instructions are stored on a non-transitory storage device, loaded into memory, and executed by a computer processor as one or more processes.

As used herein, the terms “message,” “messaging,” and “short messaging service (SMS)” each comprise the breadth of messaging services and related technologies or standards used for communicating and transmitting data over the network **120**. These technologies and services include SMS messages, multimedia messaging service “MMS” messages, proprietary messaging service messages such as BLACKBERRY messages “BBM” and the like.

FIG. 1B is a block diagram illustrating an operating environment of an agency service **115** providing MA numbers according to one example embodiment. As shown, the operating environment includes an agency **110**, monitoring devices **107**, operator devices **101**, contacts **105** and a network **120** with components such as the internet **123**, telephony **125** and provider **127**. The network **120** may also include GPS satellites (not shown) that relay position data to operator devices **101** and other devices.

Agency **110** represents a collection of servers, desktop, notebook or tablet computers, mobile telephones and related storage mediums used by respective agency personnel for executing applications or modules to communicate with and receive data from the agency service **115** (e.g., via the interface **145**) and other entities on the network **120**. For example, agency **110** devices may execute a web browser to access a web interface or execute a mobile or desktop application for communicating with an API provided by the agency service **115**. An agency **110** may also include telephonic and video infrastructure enabling audio and video communicability (e.g., internally and/or over the network **120**) using the public switched telephone network (“PSTN”), voice over internet protocol (“VoIP”) and video

conferencing services for monitoring or specifying configurations for using operator devices **101** with virtual numbers **135**.

The telephony network **125** may include servers, switches and other hardware and software for implementing, among other protocols and technologies, worldwide interoperability for PSTN communications including land-lines and 2G/3G/4G wireless protocols. The telephony network **125** also provides mobile devices with the capability to transmit and receive data over the internet **123**. The telephony network **125** is managed by one or more communication service providers “CSPs” (not shown) that own telephone numbers for use on the PSTN and the CSPs own network (e.g., a wireless network that communicates with the PSTN).

The provider **127** may include servers, switches and other hardware and software for communicating over the network **120** with CSPs and other entities. The provider **127** buys or leases numbers for use on the telephony network **125** from multiple CSPs. The provider **127**, in turn, manages numbers provisioned for use by the agency service **115** and the telephony traffic associated with the numbers. In one embodiment, the provider **127** allows the agency service **115** to provision one or more of the numbers as virtual numbers over the network **120**.

Typically, a number used on the telephony **125** network directs to a given mobile device, VoIP device or land-line device having an associated number identity characterized by automatic number identification “ANI” information, or caller identification. Virtual numbers, while still operable with the PSTN and CSP networks, are associated with the provider **127** who handles telephony traffic for the number. Because a virtual number does not direct to an end user device, the provider **127** may establish connections with devices dialing the virtual number, record call information such as call audio and caller history (e.g., on a computer readable medium) and stream/provide call information for download (e.g., over the network **120**).

The provider **127** may also pass/bridge audio (bidirectional or unidirectional) in real-time between two or more telephonic devices establishing connections with the same or different virtual numbers (or connected by the provider **127** via a virtual number). Additionally, as the virtual numbers are handled by the provider **127**, the agency service **115** may modify ANI information and caller identification associated with the virtual number.

In addition to provisioning virtual numbers for the agency service **115**, the provider **127** communicates notifications and data associated with the virtual numbers to the agency service **115** or other entity such as the agency **110**. For example, the provider **127** may notify the agency service **115** (and optionally an operator device **101** or monitoring device **107**) of an incoming caller or message to the virtual number and receive instructions from the agency service **115** to connect the caller to the virtual number (or another device) or redirect the message. In a specific example, the agency service **115** may provide instructions for the provider **125** to notify a monitoring device (e.g., **107C**) in response to use of the virtual number. The provider **125**, in turn, may dial out the monitoring device **107C** via the virtual number (or other virtual number) and pass (or bridge) audio such that the monitoring device **107C** receives the audio transmissions between the operator device **101** and contact device **105** on the virtual number. The provider **127** may also receive instructions to stop/start recordings of calls placed to the virtual number and interface with a transcription service to transcribe call audio. In turn, the provider **127** can transmit

the recordings and transcripts to the agency service **115** or other entity on the network **120**.

Additionally, the provider **127** may enable or disable inbound and/or outbound audio for different parties such as a monitoring device **107C** connected or connecting to a virtual number and recordings thereof responsive to instructions received (e.g., via an API) from the agency service **115**. The provider **127** can receive instructions for managing a virtual number and notifications as part of the provisioning process, prior to an incoming call or in real-time from the agency service **115** when connecting an incoming caller to the virtual number. In some embodiments, the provider **127** communicates directly with the agency **110**, operating device **101** and/or monitoring device **107** to provision virtual numbers, transmit notifications and data or receive instructions. Additionally, the provider **127** itself may function as a CSP and vice versa.

The agency service **115** receives requests for provisioning and mapping virtual number from the agency **110**, operator device **101**, or monitoring device **107**. The requests can include number information for provisioning virtual numbers such as an area code (e.g., **555**), country code (e.g., **+44**) and/or associated CSP. In turn, the agency service **115** queries the provider **127** for available virtual numbers matching the request and returns the matching virtual numbers to the requesting entity. The agency service **115** subsequently receives a selection of virtual numbers from the requesting entity and claims the virtual numbers from the provider **127**.

When provisioning a virtual number, the agency service **115** may optionally allow the entity to specify number information such as ANI and/or caller identification associated with the virtual number to spoof the number's identity on the network **120**. The agency service **115**, in turn, transmits instructions to the provider **127** for modifying the number identity. The agency service **115** may optionally verify the spoofed number identity. When a virtual number is no longer needed by the agency **110A**, the agency service **115** obtains any audio recordings or call logs associated with the virtual number and releases the number back to the provider **127**.

Additionally, the agency service **115** may optionally allow the entity to specify number information such as a ring tone for provisioned virtual numbers. The specified ring tone may be used to spoof the location where the number is being used on the network **120** or mimic a custom ringtone. Specifically, as ring tones can differ between countries, and for a host of other reasons, the agency service **115** may enable the entity to configure the virtual number with the provider **127** such that a specified ring tone is played when parties (e.g., a contact and operator) communicate using the virtual number. In a real world example, if the virtual number is based in the United Kingdom and the contact expects the operator using the virtual number to be in the United States, the contact may hear (incorrectly) the ring tone for the United Kingdom when dialing the virtual number (rather than the expected United States ring tone). Accordingly, the agency service **115** may provide the entity with a list of ring tones (e.g., for different countries) and/or enable the entity to upload a desired ring tone for playback to those dialing the virtual number. The agency service **115**, in turn, transmits instructions to the provider **127** for configuring the virtual number with the desired ring tone for playback. Thus, the cover of the operator may be maintained when the contact dials the virtual number.

The requests can also include mapping information for configuring claimed virtual number function in a mapping

table. Depending on the desired configuration, the mapping information may include the transmitting number of an operator device **101** and/or and monitoring device **107**, virtual number for association with the device and/or desired function of the virtual number (e.g., MA number or local number). One example mapping request may specify a claimed virtual number for use as a virtual multiple attached number (MA number) that operator devices **101** connect to in order to transmit collected data (e.g., audio) over the telephony **125** network from the MA number's identity (e.g., to contact devices **105**). In one embodiment, the request includes the transmitting number of the operator device **101** and a given claimed virtual number for configuration as the MA number. In response to the request, the agency service **115** associates the transmitting number of the operator device **101** with the MA number and stores the association in a mapping table.

Another example mapping request may specify a claimed virtual number for use as a virtual local number (local number) that monitoring devices **107** connect to in order to monitor a MA number (e.g., listen to audio transmitted between operator device **101** and a contact device **105**). The operator device **101** may also utilize the local number to avoid long distances charges for MA numbers in different countries or area codes. In one embodiment, the request includes a given claimed virtual number (e.g., the local number) and the MA number. In response to the request, the agency service **115** associates the MA number with the local number and stores the association in a mapping table.

In some embodiments, a mapping request may optionally include the transmitting number of a monitoring device **107** which the agency service **115** associates with a MA number or local number to identify the monitoring device. As multiple monitoring devices **107A**, **107B**, **107C** may monitor call audio, the agency service **115** may store multiple transmitting numbers of monitoring devices in association with a single MA number or local number in a mapping table.

In practice, agency service **115** consults the mapping table to automatically identify a device connecting to a virtual number (e.g., the MA number) as the operator device **101**, monitoring device **107** or contact device **105** based on the device's transmitting number. Thus, for example, an operator of an operator device **101** may simply dial an MA number mapped to the transmitting number of his phone to place a call using a given MA number.

Personnel with a monitoring device **107** that desire to monitor the operator device **101** with a mobile or land-line phone at the agency **110A** or in the field can dial the local number associated with the MA number (and, in some embodiments, the MA number itself). However, in one embodiment (e.g., connecting to a local number), as the agency service **115** does not identify the transmitting number of the device as that of the operator device **101**, personnel devices are appropriately identified as monitoring devices **107**. In some embodiments (e.g., connecting to a local number and/or MA number), the agency service **115** identifies connecting monitoring device **107** based on a mapping of monitoring devices' **107** transmitting numbers to the receiving number. Alternatively, the agency service **115** identifies the monitoring device **107** or operator device **101** responsive to personal identification number or code "PIN" entered when connecting to a virtual number.

Embodiments of the agency service **115** use the mapping of the operator device **101** to MA numbers for instructing the provider **127** to automatically dial (e.g., from an MA number or via call forwarding) the operator device when calls are

received from contact devices **105** on an MA number mapped to the operator device for connecting the parties. Additionally, embodiments of the agency service **115** use the mapping of the operator device **101** to MA numbers for identifying when the operator device desires to use an MA number and instructing the provider **127** to dial (e.g., from an MA number) a contact device **105** specified by the operator and connect the parties. The agency service **115** may also provide operating devices **101** with caller and MA number details through the interface **145**, via SMS message or email. Embodiments of the agency service **115** may also use mapping information to direct text messages received on an MA number to an operating device **101** and send text messages (e.g., from the operating device) from the MA number to entities on the network **120** such as contact devices **105**.

Additionally, embodiments of the agency service **115** can use the mapping of monitoring devices **107** to MA numbers (e.g., directly, or via associated local numbers) for instructing the provider **127** to automatically dial (e.g., from a specified local number or the MA number) or otherwise notify (e.g., a SMS message) monitoring devices when calls are placed or received using a given MA number. The agency service **115** may also notify monitoring devices **107** through the interface **145** or via email.

To prohibit unauthorized access to MA numbers (and local numbers), the agency service **115** may allow personnel and operators to specify key-ins when provisioning and/or mapping virtual numbers. The agency service **115** stores the key-ins in the mapping table or other suitable database structure to identify and authenticate callers attempting connections to the virtual numbers responsive to correct key-ins. Depending on the embodiment, the agency **110**, agency service **115** or provider **127** may store the mapping table and/or key-ins for device identification and authentication.

In some embodiments, the agency service **115** provides a MA module **141** to the operator device **101**. The MA module **141** interfaces with the native dialer of the operator device **101** to automate the connection process to a given contact device **105**. Additionally, the MA module **141** may interface with operator device **101** software and/or hardware to utilize features such as a GPS device to collect real-time position data. The MA module **141** transmits the collected data over the network **120** back to the agency service **115** or other entity. The agency service **115**, in turn, may store the collected data for transmission to one or more monitoring devices **107** and the agency **110**. Furthermore, the MA module **141** may be configured with a password or otherwise disguised when executed to prevent users other than the operator from accessing the module altogether and/or particular features. The MA module **141** is described in more detail with reference to FIG. 2.

In some embodiments, the agency service **115** includes an interface **145** for providing data received from operator devices **101** and call audio between operators and contacts to various monitoring devices **107** and/or appliances **150** over the network **120**. For example, the interface **145** may provide monitoring devices **107** with data corresponding to the status (e.g., connected or disconnected) of one or more operator devices **101** and the corresponding MA number and contact device information. If the operator device **101** is transmitting real-time data or connected to a contact device **105**, the interface **145** can stream data such as audio from the active transmission, GPS coordinates with heading, speed and coordinates of last-reported locations for placement on a map, and the internet protocol address and/or telephone

numbers of other personnel monitoring or having access to the operator device or MA number. In some embodiments, the interface **145** syncs collected data prior to transmission or includes tags in the transmitted data for synchronization of playback at the monitoring device **107** or operator device **101**. The interface **145** can also stream, or provide for download, previously recorded monitoring sessions.

In some embodiments, the agency service **115** provides a monitoring module **143** to monitoring devices **107** for accessing the interface **145**. The monitoring module **143** transmits requests associated with configuring an operator device **101** and receiving real-time and historic data. For example, the monitoring module **143** may provide a user interface or status dashboard with options for provisioning virtual numbers, mapping a transmitting number of an operator device **101** or monitoring device **107** to a given virtual number and assigning key-ins for connecting to the virtual number. In one embodiment, the dashboard provides an option to toggle a recording session on or off with the agency service **115**. When the recording session is disabled, the monitoring device **107** still receives real-time data, but the agency service **115**, appliance **150** and provider **127** do not store copies of the collected data.

The monitoring module **143** may also display real-time status information for the operator device **101** including current GPS location, tracked GPS location, live audio, mapping table information and other information collected from the operator device, operator device **105**, or MA number and streamed by the interface **145**. Similarly, the monitoring module **143** may be used to access and playback historic activity associated with a given virtual number or operator device **101**. For example, the monitoring module **143** may download files for playback or stream them. In addition to interfacing with the agency service **115**, the monitoring module **143** may interface with an appliance **150** that stores (or backs up) collected data within the agency **110**.

The monitoring module **143** may interface with the native dialer of the monitoring device **107** and notify the monitor when connection requests from virtual numbers are received (e.g., in instances where the monitoring device **107** is dialed in to monitor a call). Embodiments of the monitoring module **143** may also be configured to automatically establish the connection with the virtual number. The monitoring module **143** may display information for the virtual number and, optionally, the contact device **105** and/or operator device **101** using the virtual number with the notification. Displayed information for the virtual number, operator device **101**, and/or contact device **105** may include associated number information, mapping information, and/or case information stored at the agency service **115**, provider **127**, and/or appliance **150**. For example, the monitoring module **143** may communicate with the agency service **115** and/or appliance **150** to receive mapping information and case information corresponding to MA numbers (and operating devices) the transmitting number of the monitoring device **107** executing the monitoring module **143** is authorized to monitor. Additionally, the monitoring module **143** may include functionality of the MA module **141** and vice versa.

In one embodiment, the agency **110** includes an appliance **150** for storing data collected by operator devices **101** and call audio using MA numbers. The appliance **150** may utilize the monitoring interface **145** provided by the agency service **115** for updating stored data or receive data directly from operator devices **101**. Additionally, the appliance **150** may receive audio recorded on a virtual number and associated transcripts from the provider **127** or agency service **115**. One

example embodiment of the appliance **150** also includes its own interface (not shown) that enables monitoring devices **107** and operator device to access real-time and historic data stored on the appliance for an MA number. Interfaces provided by the agency service **115** or appliance **150** may also be accessible via a web browser for streaming or downloading data and include the same or similar options.

Additionally, the appliance **150** and agency service **115** may communicate to intermittently update collected data and records at defined intervals or in response to notifications to download data. During the intervals or notification periods, the agency service **115** may process the data and perform any necessary actions as desired by operator devices **101** or monitoring device **107** until the data is transferred to the appliance **150**. In some embodiments, the agency service **115** maintains a persistent connection with the appliance **150** to facilitate transfer of real-time data collected by operator devices **101** operated in the field.

In one embodiment, the agency service **115** insures that it, and the provider **127**, do not possess data collected by operator devices **101** or from a virtual number beyond the time needed to facilitate transfer. However, in mission critical situations, operators and other agency **110** personnel cannot rely only on the availability of the appliance **150** for storing and maintaining collected data. Consequently, if the appliance **150** is unable to take possession of the collected data or go offline during transfer, the agency service **115** and/or the provider **127** may maintain possession of the collected data until the appliance **150** is functioning. Furthermore, the agency service **115** and/or provider **127** may determine whether checksums, hashes or sizes of transferred data match the appliance's **150** version prior to deleting stored data.

In some embodiments, the agency service **115** maintains an appliance instead of, or in addition to, the agency **110**. In such cases, the appliance may exist as a dedicated piece of hardware or remote storage. Alternatively, embodiments of the appliance **150** may be implemented in a cloud computing and storage stack available on the network **120**.

Operator Device Functionality

FIG. **2** is a block diagram illustrating a MA module **141** according to one example embodiment. As mentioned above, the MA module **141** may be downloaded from the agency service **115** to the operator device **101** and executed to facilitate communications using MA numbers and collect and transmit data to entities on the network **120**. As shown in FIG. **2**, the MA module **141** itself includes multiple modules. In the embodiment shown in FIG. **2**, the MA module **141** includes a connection module **205**, GPS module **210**, provisioning module **215**, caller ID module **220**, case module **225** and SMS module **230**. In some embodiments, the functions are distributed among the modules in a different manner than described herein. Other embodiments have additional and/or other modules.

The connection module **205** automates the connection process for dialing out to a given contact. The connection module **205** receives input from the operator including an MA number associated with the operator device **101**. In some embodiments, the connection module **205** further receives input indicating a local number associated with the operator device **101** or the MA number. Once a connection with the MA number is established, the connection module **205** transmits the number for a contact device **105** the operator desires to call over the network **120**. The connection module **205** may allow the operator to enter the number of the contact device **105** prior to, or after establishing the connection with the MA number. Additionally, the connec-

tion module **205** may interface with the agency service **115** to receive information about MA numbers associated with a given local number or the transmitting number of the operator device **105**. The connection module **205** may then present an interface to the operator indicating one or more available MA numbers with their number information for selection.

In one embodiment, the connection module **205** detects whether incoming calls were initially placed to a MA number. The connection module **205** subsequently determines MA number and/or contact device **105** information for display to the operator. In one embodiment, the connection module **205** accesses a locally or remotely stored address book to retrieve an address book entry associated with the MA number and/or contact device **105**. Alternatively, the connection module **205** may receive and display notifications from the agency service **115** or provider **127** about incoming calls. Based on the notification or address book information, the operator may review the appropriate identity expected by the contact and/or the contact.

Depending on the operator device's **101** capabilities, the communication module **205** may enable placement/receipt of multiple outgoing and incoming calls to virtual and non-virtual numbers within the native dialer application or similar.

The GPS module **210** communicates with a native GPS receiver on the operator device **101** to receive GPS location data. The GPS module **210** may also communicate with other radio receivers and directional mechanisms (e.g., compass or accelerometers) on the operator device **101** to receive additional location data. The GPS module **210** processes the GPS and radio location data to determine and refine an estimated location measurement for the operator device **101**. The location measurement may include, but is not limited to, a latitude, longitude, altitude, heading, speed, associated accuracy measurement and the time and date of recording. The GPS module **210** transmits the determined location measurement over the network **120** the agency service **115** or other entity. In one embodiment, the GPS module **210** streams the location measurement in real-time.

The provisioning module **215** interfaces with the provider **127** or agency services **115** to provision virtual numbers and modify virtual number assignments and function in the field. Alternatively, a web browser on the operator device **101** may be used. For example, the web browser or provisioning module **215** may present the operator with a list of all virtual numbers associated with a given account, transmitting number, or local number. Through the interface, the operator may provision and modify mapping and function of the virtual numbers. Additionally, for example, the operator may specify number information for a virtual number or specify a ring tone for playback when the virtual number is dialed.

The caller ID module **220** interfaces with the provider **127** or agency services **115** to modify caller ID or other number information associated with provisioned virtual numbers. For example, the caller ID module **220** presents an interface to the operator to specify number information such as location, ownership, carrier and whether or not any of the information should be restricted or blocked when dialing out from a given MA number.

In some embodiments, the case module **225** interfaces with the provider **127**, agency services **115** or appliance **150** to retrieve activities associated with a given MA number, local number or transmitting number. For example, the case module **225** presents an interface with MA numbers that the operator may select, for example, to view associated activity and number information. The case module **225** may further

provide an interface for the operator to associate contact information or other information (e.g., address book entries) with a given MA number or contact number. The case module 225 may store the address book entries locally and/or remotely with the agency services 115 or appliance 150.

In some embodiments, the MA module 141 includes an SMS module 230 for sending SMS messages with and receiving SMS messages from an MA number. The SMS module 230 may send and receive SMS messages natively (e.g., via the provider 127) and/or send and receive non-native messages (e.g., via the agency services 115) depending on the device capabilities. The SMS module 230 provides an interface to the operator for selecting or otherwise specifying an MA number to use for sending an SMS message and the number of the contact device 105 that should receive the message. The SMS module 230 communicates (e.g., using the SMS itself or via the interface 145) the information for sending the SMS message to the agency service 115 and/or the provider 127. The SMS module 230 may further receive SMS messages sent to a MA number natively or via the interface 145. In one embodiment, the SMS module 230 mimics the look and feel of a native SMS program on the operator device 101.

In some embodiments, the MA module 141 and the modules therein interface and communicate with non-native devices attached to the operator device 101. For example, audio and location data can be determined from accessories coupled (e.g., wired microphone) or wirelessly connected (e.g., Bluetooth headset) to the operator device 101.

Additionally, some or all of the features provided by the MA module 141 may require the operator to enter a specified key-in (e.g., button press combination, password or other personal identification) prior to operation or launch.

Virtual Number Provisioning

FIG. 3A is an interaction diagram illustrating a method for provisioning 300 and mapping virtual numbers for operating an operator device 101 with MA numbers according to one example embodiment. Initially, the agency service 115 receives 310 a request including a calling code for provisioning 300 a virtual number from a monitoring device 107, operator device 101, provided web interface or other entity. The calling code can include an area code and country code where the provisioned virtual number will be operated.

The agency service 115 queries 320 the provider for virtual numbers matching the specified calling code. The provider 127 returns 330 a list of available virtual numbers to the agency service 115 which, in turn, transmits the virtual numbers for display to the requestor. The agency service 115 receives 335 one or more virtual number selections and claims 340 each selected virtual number from the provider 127. The agency service 115 may optionally include modified number information for a claimed virtual number. For example, the agency service 115 may optionally include corresponding ANI and caller identification information for a virtual number. Additionally, the agency service 115 may optionally include a ring tone specified for playback when the virtual number is dialed. The number information may be edited on the requesting device 101, 107 or in the web interface. The agency service 115 subsequently stores the modified virtual number information and instructs the provider 127 to update the associated virtual number information to configure the virtual number.

With one or more virtual numbers claimed, the agency service 115 can receive mapping requests for the virtual numbers and, in turn, map 350 the virtual numbers responsive to information in the mapping request. For example, the

requestor may be prompted to enter the transmitting number of an operator device 101 for association with a virtual number to be used as a MA number. The agency service 115 stores the transmitting number of the operator device 101 and the MA number in a mapping table (e.g., at the agency service 115 or on the appliance 150). The requestor may modify the mapping at any time, without any interruption of service at the receiving number.

Oftentimes, MA numbers have a different country code (or area code) than monitoring devices 107 or the operator device 101 connecting to an MA number to monitor or place/receive calls on the MA number. In some cases, the requestor knows the country code or area code where the monitoring devices 107 and/or operator device 101 are located. Accordingly, to avoid costly charges for the agency 110A, the agency service 115 enables the requestor to provision additional virtual numbers with the known country codes and area codes for use as local numbers. The agency service 115 may then receive mapping requests for the local numbers (e.g., to map the transmitting number of the operator device 101) and, in turn map local numbers to specified MA numbers.

When operator device 101 subsequently dials a local number, the agency service 115 identifies the associated MA number from the mapping table. The agency service 115 may further identify the transmitting number or operator PIN associated with the MA/local number and authenticate the operator device 101 (e.g., based on the transmitting number or PIN). In turn, the agency service 115 instructs the provider 127 to connect the operator device 101 to the MA number or pass audio from the MA number to the local number and connect the operator device to the local number.

When a monitoring device 107 dials a local number, the agency service 115 identifies associated MA numbers from the mapping table. The agency service 115 may further identify a monitoring number or monitor pin associated the MA/local number and authenticate the monitoring device 107. In turn, the agency service 115 instructs the provider 127 to connect the monitoring device 107 to the MA number or pass audio from the MA number to the local number and connect the monitoring device to the local number. Additionally, as the monitoring device 107 should not tip off the contact or otherwise interfere with call status (e.g., ringing, active, etc.), connection/disconnection of the monitoring device 107 (e.g., to/from a virtual number or other device or entity) may be delayed or otherwise modified (e.g., muted for the contact device 105 and optionally the operator device 105) as not to affect call status or tip off the contact.

In some embodiments, local numbers may be tied to the transmitting number of an operator device 101 for automatic mapping to MA numbers. For example, an operator using the same operator device 101 for multiple investigations in different counties may utilize a different MA number for each investigation (e.g., to keep distinct records or maintain a specific identity). Rather than requiring the operator or personnel monitoring the operator to assign local numbers (or frequently modify mapping) to each MA number on an individual basis, a local number may be tied to the operator device 101. When the operator device 101 is mapped or used with a MA number, the agency service 115 maps the tied local number to the MA number. In such a way, a given local number may be dedicated to monitoring/supporting a particular operator device 101. As multiple MA numbers may be associated with a single local number, operating devices 101 or monitoring device 107 dialing the local number may be presented with a list of the mapped MA numbers available for placing a call or monitoring. A requestor may

re-specify the mapping configuration as needed to change or swap claimed virtual numbers and transmitting numbers between MA numbers and local numbers.

Example embodiments of monitoring device 107 mapping to MA numbers and/or local numbers can be performed in the same or similar fashion as operator device 101 mappings. Monitoring device 107 mapping to MA number and/or local numbers may be used to authorize monitoring devices to listen in on call audio between an operator device 101 and contact device 105. Additionally, the mapping may be used to automatically notify a specified monitoring device 107 when the corresponding MA number is used for communications.

FIG. 3B is a table illustrating an example embodiment of virtual number mapping 350 for operating an operator device 101 with MA numbers. As shown, mapping table 360A includes a number of MA numbers 363A mapped to a corresponding transmitting number 361A (e.g., of operator device 101).

When the agency service 115 receives connection requests to MA numbers 363A from the network 120, the agency service identifies the connecting device as the operator device 101 based on the transmitting number 361A stored in the mapping table 360A. In turn, the agency service 115 or provider 127 receives a contact number from the operator device 101 and dials the corresponding contact 105 from the MA number 363A. If the connecting device's number does not match the transmitting number 361A, the agency service 115 identifies the device as a contact device 105 and dials or instructs the provider 127 to dial the specified transmitting number for the operating device 101.

Prior to permitting the operator device 101 to place a call to or receive a call from the MA number or local number, the agency service 115 may wait or instruct the provider 127 to wait for key-in of a specified password. For example, in some instances, the provider 127, telephony 125/PSTN or agency service may fail to correctly identify or pass a transmitting number of a device or a virtual number for forging a connection. If an improper password or no password is received for a local number, the device is disconnected. For a MA number, as contacts 105 dial the number, if an improper password or no password is received (e.g., within a brief time frame of placing the call) the operator device 105 is dialed. In one embodiment, the operator must enter the password or key-in enter a password (e.g., hitting * or # prior to entering the password) within a given time period (e.g., 2-5 seconds) without being prompted to mitigate suspicion when the line is dialed by another party.

Similar precautions may be implemented to authenticate monitoring devices 107 that dial the local number to monitor the call. In some embodiments, the mapping table 360A further includes mappings of monitoring device 107 transmitting numbers to explicitly identify authorized monitoring devices in addition to operating devices 101.

FIG. 3C is a table illustrating an example embodiment of virtual number mapping 350 for operating an operator device 101 with MA numbers. As shown, mapping table 360B includes a number of MA numbers 363B mapped to a corresponding transmitting number 361B (e.g., of operating device 101). Additionally shown are a number of local numbers 365 mapped to the MA numbers 363B.

When the agency service 115 receives connection requests to local numbers 365 from the network 120, the agency service identifies the connecting device as a monitoring device 107 or operator device 101 (e.g., based on mapped transmitting numbers or monitor/operator PIN) and identifies the associated MA numbers 363B from the map-

ping table 360B. The agency service 115, in turn, instructs the provider 127 to connect the device 101, 107 with a specified MA number 363B (e.g., directly, or through the local number 365).

If the agency service 115 identifies the device as the operator device 101, the operator may further enter the number of the contact they desire to dial from the MA number. The agency service 115, in turn, instructs the provider 127 to dial out to the specified contact number from the MA number.

Prior to connecting the monitoring device 107 or operator device 101, key-in of a specified password may be required. In some embodiments, the mapping table 360B further includes mappings of monitoring device 107 transmitting numbers to explicitly identify authorized monitoring devices in addition to operator devices 101.

FIG. 3D is a table illustrating an example embodiment of virtual number mapping 350 for automatically notifying a monitoring device 107. As shown, mapping table 360C includes a number of MA numbers 363B mapped to a corresponding monitoring number 367 (e.g., of monitoring device 107).

When the agency service 115 receives connection requests to MA numbers 363C from the network 120, the agency service may identify the connecting device as a contact device 105 or operator device 101 using, for example, mapping table 360A and/or 360B as described above. The agency service 115 enables operator devices 101 to specify a contact device 105 for dialing out to from the MA number 363C and contact devices 105 to communicate with the operator device 101 corresponding to the dialed MA number 363C. In either instance, the agency service 115 may identify one or more monitoring numbers 367 associated with the MA number 363C. The agency service 115, in turn, may automatically instruct the provider 127 to dial out to the identified monitoring numbers 367 when the MA number 363C is used such that the monitoring devices 107 may receive call audio in real-time.

In the embodiment shown in FIG. 3D, the agency service 115 may instruct the provider 127 to dial out from the MA number 363C or otherwise connect the monitoring device 107 with the MA number 363C. In such cases, audio transmitted from the monitoring device 107 or associated with connection process (e.g., any dial tones) to the MA number 363C may be disabled.

In other embodiments, a monitoring number 367 may be associated with a MA number 363C via mapping to a corresponding local number 365 (not shown). Accordingly, the agency service 115 identifies monitoring numbers 367 based on the mapping to the local number 365. In such cases, the agency service 115 may instruct the provider 127 to dial out to identify monitoring numbers 367 via the local numbers 365 and pass call audio from the MA number to the local number. Depending on the embodiment, the agency service 115 may instruct the provider 127 to disable audio from the local number 365 to the MA number 363 or from the monitoring devices 107.

FIG. 4 is an interaction diagram illustrating a method for connecting 400 an operator device 101 and contact 105 using a virtual number according to one example embodiment. FIG. 4 additionally illustrates a method for connecting 400 a monitoring device to virtual number according to one example embodiment. Once the agency service 115 provisions 300 a virtual number with the provider 127, an operator device 105, monitoring device 107 or contact 105 may connect 400 to the virtual number. However, each entity may be treated differently as explained below.

For any device **101**, **105** or **107** dialing **410** the virtual number, the provider **127** receives the connection request via the telephony network **125** and identifies **420** the dialed number as a virtual number provisioned **300** by agency service **115**. Accordingly, in embodiments where the agency service **115** stores the mapping table, the provider **127** passes the transmitting number of the device attempting to connect to the virtual number and the virtual number to the agency service **115**.

The agency service **115**, in turn, identifies **430** the device attempting to connect to the virtual number as an operator device **101**, monitoring device **107** or contact **105** based on the mapping table. The agency service **115**, in turn, instructs the provider **127** to connect (or disconnect) **440** the identified device and provide options or perform operations according to the device's classification.

Operator Device

In the case of the operator device **101** dialing an MA number, the agency service **115** determines that the transmitting number stored in the mapping table for the dialed MA number matches the number of the device attempting to connect to the MA number. The agency service **115** then instructs the provider **127** to connect **440** the device to the MA number as the operator device **101**.

Alternatively, if the agency service **115** determines that the operator device **101** is attempting to connect to a local number, the agency service determines that the transmitting number stored in the mapping table for the dialed local number (and/or associated MA numbers) matches the number of the device. The agency service **115** then instructs the provider **127** to connect **440** the device to the local number as the operator device **101**. If only one MA number exists in the mapping table for the local number, the agency service **115** may automatically instruct the provider **127** to connect the operator device **101** with the MA number (e.g., directly or via the local number). Alternatively, if there are multiple MA numbers assigned to the local number, a menu with details about the MA numbers may be provided for the operator to select a given MA number. For example, "press 1 for John Doe," "press 1 for Restricted/Blocked" or "press 1 for 555-111-5555" where "John Doe" and "555-111-5555" may be number information for a corresponding MA number and restricted or blocked indicates that an MA number will not display number information when used.

Once the operator device **101** connects to the desired MA number (e.g., via selection or directly), the operator may enter the number of the contact device **105** (e.g., transmitting number of the contact's device) that the operator would like to dial from the MA number. The provider **127**, in turn, dials out **500** to the contact number from the MA number (displaying MA number information) and connects the parties. In some embodiments, the agency service **127** may identify a monitoring number of a monitoring device **107** associated with the MA number or local number in the mapping table. The agency service **127**, in turn, may instruct the provider **127** establish a connection with the monitoring device **107** for passing call audio between the contact device **105** and the operator device **101** on the MA number. Example embodiments of dialing out to a contact device **105** are explained in more detail with reference to FIG. 5A.

Monitoring Device

In the case of a monitoring device **107** dialing a MA number, the agency service **115** may determine that a transmitting number for a monitoring device stored in the mapping table for the dialed MA number matches the number of the device. The agency service **115** then instructs the provider **127** to connect **440** the device to the MA

number as a monitoring device **107** and disable (e.g., mute) audio received from the monitoring device **107**. FIG. 3D illustrates an example mapping table for specifying transmitting numbers of monitoring devices that may be automatically dialed in to monitor a MA number, according to one embodiment. A similar table may be used to authorize monitoring device **107** access to MA numbers and/or further indicate which monitoring devices **107** having general access should be dialed in when a MA number is used by an operator.

Alternatively, if the agency service **115** determines that the device is attempting to connect to a local virtual number, the agency service may determine that the number of the device does not match the transmitting number of the operator device stored in the mapping table. For example, the agency service **115** may determine the operator device **101** transmitting number stored in the mapping table for the dialed local number (and/or associated MA numbers) and identify devices connecting to the local number that do not match the operator device's transmitting number as monitoring devices. In other embodiments, the agency service **115** may identify the monitoring device **107** based on matching a monitoring device transmitting number stored in a mapping table for the local number or MA numbers with that of the connecting device. The agency service **115** then instructs the provider **127** to connect **440** the device to the local number as the monitoring device **107**. If only one MA number exists for the local number, the agency service **115** may automatically instruct the provider **127** to connect the monitoring device to the MA number as described above (e.g., with audio disabled) or, alternatively, pass audio from the MA number (e.g., call audio between the operator and contact) to the local number. Audio from the local number to the MA number may be disabled such that audio received from monitoring devices need not be disabled on the local number. Alternatively, if there are multiple MA numbers assigned to the local number, a menu with details about the MA numbers may be provided for the operator to select a given MA number. The provider **127** and/or the agency service **115** may additionally notify personnel using the monitoring device **107** which MA numbers are active.

In some embodiments, the monitoring devices **107** may communicate with other devices monitoring a given MA number through a local number (e.g., like a conference call) although no audio is transmitted to the contact device **105** and operator device **101** on the MA number. Additionally, the provider **127** or agency service **115** may provide the monitoring devices **107** with key combinations (e.g., *1, 2, etc.) to mute other monitoring devices **107**, audio on the MA number or their own device.

Contact Device

In one embodiment, the agency service **115** identifies **430** devices with numbers that do not match a transmitting number stored in the mapping table for a MA number as contact devices **105**. The agency service **115** identifies the transmitting number associated with the MA number and instructs the provider **127** to connect **440** the contact device **105** to the operator device **101** (e.g., by dialing out **500** to the operator device **101** directly, or through the MA number). In some embodiments, the agency service **127** may identify a monitoring number of a monitoring device **107** associated with the MA number in the mapping table. The agency service **127**, in turn, may instruct the provider **127** establish a connection with the monitoring device **107** for passing call audio between the contact device **105** and the operator device **101** on the MA number. Example embodiments of

dialing out **500** to the transmitting number of an operator device **101** are explained in greater detail with reference to FIG. **5B**.

Additional Considerations

In some embodiments, the PSTN or provider **127** fails to pass the transmitting number associated with an operator device **101** (or monitoring device **107**) to the provider or agency service **115**. For example, the provider **127** or agency service **115** may receive a number other than the operator device's **101** and incorrectly identify the operator device. Some example PSTN and provider **127** failures are all zeroes numbers (+00 000-000-0000), restricted numbers (737-874-2833) or simply an incorrect number for the operator device **101**. In any instance, the agency service **115** may be unable to identify the operator device **101** by the received transmitting number.

The agency service **115** may recognize that some numbers are passed incorrectly (e.g., a restricted number or zeroes number). In response (e.g., for calls to a local number), the agency service **115** may play a prompt or instruct the provider **127** to play a prompt such as "press 1 for an operator device or press 2 for a monitoring device." The prompt can also be ambiguous (e.g., please enter the extension of the party you are trying to reach or similar). Operators or personnel may then key-in as using an operator device **101** or monitoring device **107**.

Alternatively, as the key-ins of the operator device **101** and monitoring device **107** typically differ, the agency service **115** may instruct the provider **127** to simply play a generic tone or number not available recording to notify users that they need to key-in. The matching of a key-in with stored authentication information identifies the operator device **101** (or monitoring device **107**) on the local number.

In some embodiments, the agency service **115** may prompt all devices connecting the local number to key-in for identification. For example, an agency **110A** may want to enable the option to use unmapped devices as operator devices **101** on a specified MA number.

While prompts are effective for identification on a local number (e.g., as only operators and personnel typically have knowledge of the number and it may further require key-in of a PIN), these methods are ineffective for number pass failures to MA numbers as contacts **105**, typically, must be tricked into believing they are making a legitimate, confidential call when they (as opposed to the operator device **101** or monitoring device **107**) dial the MA number. Accordingly, PSTN or provider **127** failures to pass the transmitting number associated with a device making a call to an MA number may be handled differently.

In one embodiment, the agency service **115** may instruct the provider to begin the dial out **500** process as if the unidentified device were a contact device **105**. Once the dial out **500** begins, the operator or personnel will realize that their device was not recognized (e.g., because no menu was presented or prompt was played and the provider **127** is dialing out). The contact, on the other hand, would assume operation as normal. In order to capitalize on this difference, the agency service **115** may instruct the provider **127** to capture a key-in during the dialing process for identifying the requesting device as a monitoring device **107** or operator device **101**. The requesting device is then identified and connected according to the provided key-in.

Operating an Operator Device

FIG. **5A** is an interaction diagram illustrating a method for dialing out **500A** to a contact device **105** using a MA number, according to one example embodiment. Once the connection **400** between the operator device **101** and the MA

number is established, the operator may enter the transmitting number of a contact device **105**. Alternatively, the number of the contact device **105** may have been previously entered in an application. In either instance, the operator device **101** transmits **510** the dial out number to the provider **127**. The provider **127**, in turn, dials out **515** to the contact device **105** from the MA number. Thus, when the contact device **105** receives the connection request, the call appears to be coming from the MA number. Accordingly, the contact device **105** will display number information (if any, e.g., for blocked or restricted number) for the MA number rather than the operator device **105**. If the contact device **105** picks up, the provider **127** establishes **520** a connection between the operator device **105** and the contact device **105** (e.g., through the MA number or local number, or directly as the contact device will not receive additional number or device information from the operator device). The operator device **101** and/or provider **127** may optionally transmit the number of the contact device **105** to the agency service **115** for records keeping or to open a new record.

Once the connection **520** between the operator device **101** and the contact device **105** is established, the provider **127** may begin recording audio on the line. The operator device **101** collects audio data using a microphone coupled to the operator device. The operator device **101**, in turn, transmits **525** the collected audio data to the provider **127** and contact device **105** by way of the connection through the MA number. The contact device **105** communicates with the operator device **101** in a similar fashion. The provider **127** may additionally enable monitoring devices **107** to connect to the MA number or local number to monitor the call and/or transmit the audio data received from the operator device **101** and the contact device **105** to the agency service **115** or appliance **150** over the network **120**.

Furthermore, the operator device **101** may also collect location data from GPS receivers and other direction mechanisms coupled to the operator device. The operator device **101** may determine a location measurement including the position of the operator device, direction and speed of the operator device and associated accuracy of the measurement. The operator device **101** transmits **525** the location measurement to the agency service **115**. In some embodiments, the operator device **101** determines and transmits **525** the location measurements in real-time to the agency service **115**.

The provider **127** and/or the agency service **115** may update **530** the appliance **150** with the received audio data. The agency service **115** or provider **127** may also update **530** the appliance with any other data received from the provider **127** and/or operator device **101**.

In some embodiments, the agency service **115** may instruct the provider **127** to automatically dial in **600** a monitoring device **107** for receiving call audio between the operator device **101** and contact device **105**. The agency service **115** may identify monitoring devices **107** to dial in **600** based on mapping table information, for example, as illustrated in FIG. **3D**. In one embodiment, the provider **127** dials in **600** the monitoring device **107** temporally proximate to dialing out **515** to the contact such that the monitor substantially receives call audio in real time. Other embodiments may dial in **600** a monitoring device in an order other than that illustrated in FIG. **5A**.

FIG. **5B** is an interaction diagram illustrating a method for dialing out **500B** to an operator device **101** using a MA number, according to one example embodiment. As described above, the contact device **105** initiates **400** a connection to a MA number and the agency service **115**

instructs the provider 127 to connect the contact device 105 to the operator device 101. Accordingly, the agency service 115 transmits 510 the transmitting number of the operator device 101 as stored in the mapping table for the MA number to the provider 127. Depending on the embodiment, the agency service 115 and/or provider 127 may be configured to coordinate connection of the contact device 105 with the MA number and subsequent dialing the operator device 101 or dialing the operator device 101 directly.

Connection Through MA Number

The agency service 115 may instruct the provider 127 to connect the contact device 105 to the MA number but continue to play a ring tone on the line after establishing the connection. In effect, the contact device 105 is connected to the MA number but does not know a connection has already been established because the ring tone is still playing. Temporally proximate to establishing the connection between the contact device 105 and the MA number, the provider 127 dials out 515 to the provided transmitting number of the operator device 101. In response to the operator device 101 answering the call, the provider 127 stops the ring tone played for the contact device 105 and establishes the connection 520 between the parties. If the operator device 101 does not answer, the provider 127 may direct the contact device 105 to a voice mail box associated with the MA number or disconnect the contact device 105.

As ring tones can differ between countries, and for a host of other reasons, the ring tone played for the contact may need to differ from a default ring tone for the MA number, e.g., based on the location of where the MA number is based. For example, if the MA number is based in the United Kingdom and the contact expects the operator to be in the United States, the contact may hear an incorrect ring tone as the United Kingdom ring tone may be played. Accordingly, the agency service 115 may instruct the provider 127 to play, and continue to play a ring tone specified (e.g., a specified mp3 file) for the MA number. The ring tone specified for the MA number may be that of the location where the MA number is based (e.g., default, based on country code) or that of a location where the operator using the MA number is expected to be (e.g., configured, by the agency service 115 or other entity). Thus, the expected ring tone may be played for the contact.

Direct Connection

The agency service 115 may instruct the provider 127 to connect the contact device 105 to the operator device 101 by forwarding the call to the transmitting number of the operator device 101 to dial out 515. Typically, this process would result in the contact hearing the ring tone of the operator device 101. As ring tones can differ between countries, and for a host of other reasons, the ring tone being played may be different than the ring tone expected for the MA number. For example, if the MA number is based in the United Kingdom and the operator device 101 is located in the United States, the ring tones may differ. If the contact expects the operator to be in the United States, the contact would hear the expected ring tone. However, if the contact expects the operator to be in the United Kingdom, the contact may hear an incorrect ring tone. Additionally, if the contact expects the operator to be in a country other than the United Kingdom or United States, the contact may hear an incorrect ring tone in either case. Accordingly, the agency service 115 may instruct the provider 127 to play the ring tone specified (e.g., a specified mp3 file) for the MA number rather than that of the operator device 101 being dialed. The ring tone specified for the MA number may be that of the location where the MA number is based (e.g., default, based

on country code) or that of a location where the operator using the MA number is expected to be (e.g., configured, by the agency service 115 or other entity). Thus, the expected ring tone may be played for the contact.

In some embodiments, the provider 127 plays an mp3 file of the ring tone specified for the MA number to the contact device 105. Alternatively, the provider 127 may dial the MA number itself, where the MA number is configured with the desired (or default) ring tone, and pass the ring tone audio to the contact device 105. In either instance, the provider 127 suppresses the ring tone of the operator device 101, for example, by disabling audio from the operator device, until the operator device 101 answers the call. Once the operator device 101 answers, the provider 127 establishes the connection 520 between the parties and may pass audio on the line between the parties and optionally to a local number or monitoring device 107 connected to the MA number for monitoring and/or recording. If the operator device 101 does not answer, the provider 127 may direct the contact device 105 to a voice mail box associated with the MA number or disconnect the contact device.

In some embodiments, the provider 127 and/or agency service 115 may provide notification information 517 to the operator device 101. The notification information 517 includes contact device 105 and/or MA number information describing the caller and identity expected from the operator. In some embodiments, notification information 517 may be injected into, or included with, caller identification information provided for a typical call. In other embodiments, notification information 517 may be provided in a SMS message or otherwise transmitted to the operator device 101 for display using an MA module 141. In one embodiment, rather than immediately establishing 520 the connection between the operator device 101 and the contact device 105 when the operator device 101 answers, the provider 127 transmits audio data including notification information 517 for the operator. The agency service 115 may further instruct the provider 127 to provide options to accept the call, disconnect the call or forward the call to voicemail of the MA number (e.g., by hanging up or selecting a provided option).

Once the connection 520 between the operator device 101 and the contact device 105 is established, the provider 127 records audio on the line. The operator device 101 collects audio data using a microphone coupled to the operator device. The operator device 101, in turn, transmits 525 the collected audio data to the provider 127 and contact device 105 by way of the connection through the MA number. The contact device 105 communicates with the operator device 101 in a similar fashion. The provider 127 may additionally enable monitoring devices 107 to connect to the MA number or local number to monitor the call and/or transmit the audio data received from the operator device 101 and the contact device 105 to the agency service 115 or appliance 150 over the network 120.

Furthermore, the operator device 101 may also collect location data from GPS receivers and other direction mechanisms coupled to the operator device as described above with reference to FIG. 5A. The provider 127 and/or the agency service 115 may update 530 the appliance 150 with the received audio data. The agency service 115 or provider 127 may also update 530 the appliance with any other data received from the provider 127 and/or operator device 101.

In some embodiments, the agency service 115 may instruct the provider 127 to automatically dial in 600 a monitoring device 107 for receiving call audio between the operator device 101 and contact device 105. The agency

service **115** may identify monitoring devices **107** to dial in **600** based on mapping table information, for example, as illustrated in FIG. 3D. In one embodiment, the provider **127** dials in **600** the monitoring device **107** temporally proximate to dialing out **515** to the operator such that the monitor substantially receives call audio in real time. Other embodiments may dial in **600** a monitoring device in an order other than that illustrated in FIG. 5B.

SMS Communications

In addition to placing and receiving calls through virtual numbers, the operator device **101** may also send and receive SMS messages through MA numbers. Depending on the embodiment of the operator device **101**, SMS messages may be sent/received via native SMS capability or using an application or web browser. Thus, the operator device **101** need not require telephony capability for SMS communications through a MA number.

Sending a SMS Message

In one embodiment, to send an SMS from a MA number to the contact device **105**, the operator prepends or appends (e.g., manually or using a MA module **141**) a native SMS message (e.g., To: [contact number]|The meeting is at 10 am) sent to the MA number from the operator device **101** to indicate the intended contact device **105**. The provider **127** forwards SMS messages received on the virtual numbers to the agency service **115** for processing. The agency service **115** parses the SMS to determine information about the contact device **105**, such as a transmitting number prepended or appended to the SMS message. The agency service **115** may also parse the SMS to determine the transmitting number of the source (e.g., for look-up in a mapping table) and/or key-in information for authentication of the source. In turn, the agency service **115** extracts the transmitting number of the contact, any device information associated with the operator device and any formatting or key-in information from the SMS message. The agency service **115** then instruct the provider **127** to transmit the modified SMS message to the extracted contact number from the MA number that originally received the SMS. In some embodiments, the MA module **141** provides an interface for the user to enter an MA number and contact number, which are automatically attached to the SMS.

Alternatively, embodiments of the operator device **101** may communicate data for transmitting via SMS from the MA number to the agency service **115**. For example, embodiments of the MA module **141** or a web interface may provide a menu or interface for the user to enter or otherwise select a given MA number and transmitting number of a contact device **105**. The interface further provides the operator with the ability to enter message content. The operator may then submit the message and associated information to the agency service **115**. The agency service **115** then instructs the provider **127** to transmit an SMS message containing the message to the specified contact number from the specified MA number.

Once the SMS is delivered, the provider **127** and/or agency service **115** may confirm receipt of the SMS at the contact device **105** with operator device **101** or other entity and/or update the appliance **150** with a copy of the SMS and associated information.

Receiving a SMS Message

In one embodiment, to receive an SMS sent to a MA number from the contact device **105**, the provider **127** transmits data (e.g., SMS messages) received on the virtual numbers to the agency service **115** for processing. The agency service **115** may then parse the SMS. However, as the SMS message content does not include appended or

prepended information (e.g., in the correct format with a transmitting number), the agency service **115** identifies the SMS message as an inbound message on the MA number for delivery to the operator device **101**. The agency service **115** may also determine information about the received message, the contact device **105** (e.g., the transmitting number of the device) and/or MA number the message was received on and append or prepend a SMS message with the information. In turn, the agency service **115** determines the transmitting number of the operator device **101** associated with the MA number that received the SMS message and instructs the provider **127** to transmit the SMS message to the operator device **101** with any attached information.

The agency service **115** may instruct the provider to transmit SMS messages to the operator device **101** from the MA number the message was received on to prevent inadvertent, direct communication with the contact device **105**. For example, the agency service **115** or provider **127** may prepend a SMS message with the transmitting number of the contact device the original SMS message was received from. In turn, the agency service **115** may and send the prepended SMS, including the original message content (e.g., From: [contact number]|The meeting is at 10 am), from the MA number to the operator device **101**.

In some embodiments, the MA module **141** provides an interface for the user to view SMS messages. The MA module **141** may parse the SMS message to determine MA number and/or contact device **105** information attached by the agency service **115** and extract the attached information for presentation in an interface.

Alternatively, the agency service **115** may communicate content from SMS messages received on an MA number and associated contact and MA number information to the operator device **101**. For example, embodiments of the MA module **141** may receive and display messages and associated information in an interface for the operator. Alternatively, the agency service **115** may provide a web interface to display the received SMS and associated information.

Once the SMS is delivered, the provider **127** and/or agency service **115** may confirm receipt of the SMS at the operator device **101** or other entity and/or update the appliance **150** with a copy of the SMS and associated information.

In some embodiments, the agency service **115** may notify a monitoring device **107** when SMS messages are sent from the MA number. As described above, messages from the operator device **101** to the contact device **105** (and vice versa) may be sent through the virtual number, albeit with a different format. Thus, for example, whenever the agency service **115** instructs the provider **127** to send a SMS message using the MA number, the agency service **115** may prepare a notification for transmission to the monitoring device **107** based on the sent SMS message information. In one embodiment, the notification is also a SMS message, which is prepended with contact, MA number and/or operator information. The SMS message may be transmitted to the monitoring device **107** from the MA number or communicated in another manner such as using the local number or email. In the case of transmission using the MA number, the agency service **115** may minimally prepend the notification with contact information and whether the contact is receiving the SMS from or sending the SMS to the operator (e.g., From/To: [contact number]|The meeting is at 10 am) as the monitor can identify the operator from the MA number.

Monitoring an Operator Device

FIG. 6 is an interaction diagram illustrating a method for dialing in **600** a monitoring device **107** to monitor an

operator device **101** according to one example embodiment. As described above, the agency service **115** and/or provider **127** may provision virtual numbers and store mapping information **300** for the virtual numbers in mapping table (e.g., as shown in FIG. **3D**). In some embodiments, the agency service **115** may store a mapping table associating MA numbers with monitoring numbers (transmitting numbers of monitoring device **107**) to identify monitoring device for automatically receiving call audio between a operator device **101** and contact device **105**.

In one embodiment, the agency service **115** detects **610** the initiation of a dial out using a MA number. For example, the agency service **115** may detect when dial out instructions **605** are transmitted to the provider **127** or processed at the provider to perform a dial out. The dial out instructions **605** may comprise instructions for the provider **127** to establish a connection between a contract device **105** and operator device **101** using a MA number. For example, as shown in FIG. **5A**, the agency service **115** may detect when the provider **127** receives the dial out number transmitted **510** by the operator device or when the provider **127** begins to dial out **515** to the content. In another example, as shown in FIG. **5B**, the agency service **115** may detect when an operator number is transmitted **510** to the provider **127** or when the provider **127** begins to dial out **515** to the operator.

Once the agency service **115** detects **610** the initiation of a dial out by way of a MA number, the agency service identifies **620** any monitoring numbers associated with the MA number in the mapping table (e.g., as shown in FIG. **3D**). In turn, the agency service **115** transmits instructions **630** to the provider **127** for dialing in the monitoring device to receive call audio on the MA number. The agency service **115** may identify **620** multiple monitoring numbers and transmit instructions enabling multiple monitoring device **107** to receive call audio.

The provider **127** receives the instructions and establishes **640** a connection with the monitoring device **107**. For example, the provider **127** may dial in the monitoring device **107** from the MA number associated with the monitoring number (transmitting number) of the monitoring device. While the monitoring device **107** is being dialed in, a connection between contact device **105** and operator device **101** may be in the process of being established or already established. In either instance, the provider **127** may disable audio from the monitoring device **107** such that the contact is (or will be) unaware of the monitor's presence on the line. In another example embodiment, the provider **127** may establish **640** the connection with the monitoring device **107** through a local number.

In some instances, the connection with the monitoring device **107** may be established prior to the connection between the contact device **105** and operator device **101**, for example, if the monitor answers the dial in before both of the contact device **105** and operator device **101**. In turn, the agency service **115** and/or the provider **127** may inform the monitor of the status of the connection between the contact device **105** and the operator device **101**. For example, the provider **127** may play an audio message "Please wait while the parties are connected."

In some instance, the connection with the monitoring device **107** may be established after the connection between the contact device **105** and operator device **101** has ended, for example, the call between the contact and operator lasts only 10 seconds and the monitor answers the dial in at 13 seconds. In turn, the agency service **115** and/or the provider **127** may inform the monitor of the status of the connection between the contact device **105** and the operator device **101**.

For example, the provider **127** may play an audio message "The call has already ended, Goodbye."

Additionally, the agency service **115** and/or the provider **127** may prompt the monitor to enter a key-in or key selection within a predetermined period of time from initiating the dial in **600**. For example, when establishing **640** the connection the monitor may be required to "Press 1 to join the call in progress" (e.g., in response to an audible prompt), where pressing 1 causes the provider to connect the monitoring device **107**. Providing the key-in or key selection indicates to the provider **127** that the monitor is on the line and optionally authenticates the monitor. Failure to provide the key in or key selection within the predetermined period of time may cause the provider **127** to terminate the connection, thus preventing a partial conversation between the contact and operator from being saved to the monitor's voicemail or an unauthorized person from monitoring the call.

FIGS. **7A** and **7B** are example interaction diagrams illustrating methods for monitoring **700** an operator device **101** according to an embodiment. A monitoring device **107** may monitor **700A**, **700B**, **700C** the operator device **101** using the example processes outlined below.

As described above, and illustrated in FIG. **7A**, the agency service **115** receives **710A** collected data from the operator device and/or the provider **127**. Additionally, the provider **127** may receive data **710B** from the operator device **101**. The collected data **710** may include call audio between the operator and the contact, GPS data, etc. In turn, the agency service **115** and/or provider **127** may update **530** the appliance at the agency **110**.

Referring to FIG. **7A**, in one embodiment, the monitoring device **107** connects **400** to a local number or MA number for monitoring **700A** the operator device **101**. The monitoring device **107** may be connected **400** by answering an incoming call from the local or MA number initiated by the provider **127** or dialing a virtual number directly as described with reference to FIG. **4**.

Once the connection between the monitoring device **107** and the MA number or local number is established, the monitoring device **740** receives the live audio transmitted between the operator device **101** and the contact device **105**. To continue monitoring **700A** the operator device **101**, the monitoring device **107** simply maintains the connection **400** with the virtual number.

In another embodiment, the monitoring device **107** connects **750** to the agency service **115** and/or appliance **150** for monitoring **700C** the operator device **101**. The monitoring device **107** may establish the connection **750** using a web browser or monitoring module **143** that retrieves or streams collected data via a monitoring interface on the appliance **150** or agency service **115** (e.g., monitoring interface **145**).

In one example embodiment, the monitoring device **107** streams **660** audio and/or location measurements in real-time from the agency service **115**. In addition, the monitoring device **107** can retrieve **670** historical data stored on the appliance **150** to view previously recorded operator device **101** operating sessions **500**. In some embodiments, the appliance **150** also supports real-time monitoring.

Referring now to FIG. **7B**, in another embodiment, the monitoring device **107** receives **600** a dial in to monitor **700C** call audio, for example on the MA number being used to established the connection between the contact device **105** and the operator **101**. The monitoring device **107** may receive **600** the dial in as a connection request from the MA number or alternatively, a local number associated with the MA number.

If the monitoring device **107** answers the dial in request, the provider **127** establishes a connection between the monitoring device **107** and the MA number or local number. Once the connection is established, the provider **127** ensures the monitoring device **107** receives **740** the live audio transmitted between the operator device **101** and the contact device **105**. To continue monitoring **700C** the operator device **101**, the monitoring device **107** simply maintains the connection. In order to avoid alerting the contact to the monitor device's **107** presence on the line, the provider **127** may disable incoming audio from the monitoring device. As the monitoring device **107** may receive the dial in **600** in real-time with the call between the contact and the operator (e.g., as the connection between the operator device **101** and contact device **105** is being established, or subsequent to the operator device **101** and contact device **105** being connected), the agency service **115** and/or provider **127** may receive **710** data such as call audio, GPS, etc. and/or update **530** the appliance prior to, during, and/or subsequent to monitoring process **700C**.

Additionally, the monitoring module **143** may interface with the native dialer of the monitoring device **107** and notify the monitor when a dial in is received **600**. The monitoring module **143** may display information associated with the dial in such as number information for the parties and MA number being used - - - -, mapping information, and/or case information stored at the agency service **115**, provider **127**, and/or appliance **150**. For example, the monitoring module **143** may communicate with the agency service **115** and/or appliance **150** to receive mapping information and case information corresponding to MA numbers (and operating devices) the transmitting number of the monitoring device **107** executing the monitoring module **143** is authorized to monitor.

In some instances, the monitoring device **107** receives notifications from the monitoring interface **145** for display in the web browser or with the monitoring module **143**. Example notifications include audio or visual alerts for notifying personnel if the operator device **101** stops transmitting real-time data (e.g., ends the call). In some embodiments, the monitoring device **107** may also retrieve or receive SMS communications between the operator device **101** and the contact device **105** using the monitoring interface **145** for display in the web browser, with the monitoring module **143**, or via a SMS generated for the monitoring device, e.g., prepended with contact information (and optionally MA number and/or contact information).

SUMMARY

The foregoing description of the embodiments has been presented for the purpose of illustration; it is not intended to be exhaustive or to limit the disclosure to the precise forms disclosed. Persons skilled in the relevant art can appreciate that many modifications and variations are possible in light of the above disclosure.

Some portions of this description describe the embodiments in terms of algorithms and symbolic representations of operations on information. These algorithmic descriptions and representations are commonly used by those skilled in the data processing arts to convey the substance of their work effectively to others skilled in the art. These operations, while described functionally, computationally, or logically, are understood to be implemented by computer programs or equivalent electrical circuits, microcode, or the like. Furthermore, it has also proven convenient at times, to refer to these arrangements of operations as modules, with-

out loss of generality. The described operations and their associated modules may be embodied in software, firmware, hardware, or any combinations thereof.

Any of the steps, operations, or processes described herein may be performed or implemented with one or more hardware or software modules, alone or in combination with other devices.

Embodiments may also relate to an apparatus for performing the operations herein. This apparatus may be specially constructed for the required purposes, and/or it may comprise a general-purpose computing device selectively activated or reconfigured by a computer program stored in the computer. Such a computer program may be stored in a non-transitory, tangible computer readable storage medium, or any type of media suitable for storing electronic instructions, which may be coupled to a computer system bus. Furthermore, any computing systems referred to in the specification may include a single processor or may be architectures employing multiple processor designs for increased computing capability.

Embodiments may also relate to a product that is produced by a computing process described herein. Such a product may comprise information resulting from a computing process, where the information is stored on a non-transitory, tangible computer readable storage medium and may include any embodiment of a computer program product or other data combination described herein.

Finally, the language used in the specification has been principally selected for readability and instructional purposes, and it may not have been selected to delineate or circumscribe the inventive subject matter. It is therefore intended that the scope of the disclosure be limited not by this detailed description, but rather by any claims that issue on an application based hereon. Accordingly, the disclosure of the embodiments is intended to be illustrative, but not limiting, of the scope of the disclosure, which is set forth in the following claims.

What is claimed is:

1. A computer based method comprising:

configuring a virtual number with a provider of the virtual number, the virtual number configured with number information operable on a public switched telephone network (PSTN) and to playback a specified ring tone to telephonic devices requesting to connect to the virtual number, the virtual number associated with a transmitting number on the PSTN corresponding to an operator device in a mapping table and the specified ring tone spoofing the location of the operator device; receiving information in response to a request from a telephonic device to connect to the virtual number associated with the operator device, the information including a transmitting number on the PSTN corresponding to the telephonic device and the virtual number, the telephonic device receiving audio corresponding to the specified ring tone spoofing the location of the operator device;

automatically identifying the telephonic device as the operator device or a contact device based on a comparison of the transmitting number on the PSTN of the telephonic device with the transmitting number on the PSTN of the operator device stored in association with the virtual number in the mapping table;

in response to identifying the telephonic device as the contact device or the operator device, transmitting instructions for establishing a first connection between the contact device and the operator device through the virtual number for transmitting audio;

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- automatically identifying a transmitting number on the PSTN of a monitoring device stored in association with the virtual number in the mapping table; and automatically transmitting instructions for establishing a second connection with the monitoring device responsive to the identified transmitting number on the PSTN of the monitoring device, the second connection configured to:
- 5 permit the monitoring device to receive audio communications between the contact device and the operator device on the first connection; and
 - 10 prevent the contact device and the operator device from receiving audio associated with the second connection, the audio associated with the second connection comprising audio from establishing the second connection with the monitoring device and audio received on the second connection from the monitoring device for a duration of the second connection.
2. The method of claim 1, wherein identifying the telephonic device as the contact device comprises transmitting instructions for connecting the contact device with the operator device associated with the virtual number to establish the first connection.
3. The method of claim 1, wherein identifying the telephonic device as the operator device comprises receiving information including a transmitting number on the PSTN corresponding to a contact device from the operator device and transmitting instructions for connecting the operator device with the contact device through the virtual number to establish the first connection.
4. The method of claim 1, wherein the duration of the second connection comprises providing the audio communications between the operator device and the contact device on the first connection to the monitoring device over the second connection.
5. The method of claim 1, wherein the duration of the second connection comprises providing the audio communications between the operator device and the contact device on the first connection to the monitoring device over the second connection and terminating the second connection.
6. The method of claim 1, wherein the instructions establishing the second connection permitting the monitoring device to receive audio communications include instructions for connecting the monitoring device with a second virtual number and passing audio communications between the operator device and contact device to the second virtual number.
7. The method of claim 1, wherein the instructions establishing the second connection permitting the monitoring device to receive audio communications include instructions for connecting the monitoring device with the virtual number.
8. The method of claim 1, wherein the telephonic device is identified as the operator device in response to a match between the transmitting number of the telephonic device with the transmitting number of the operator device stored in association with the virtual number in the mapping table.
9. The method of claim 1, wherein the telephonic device is identified as the contact device in response to a lack of match between the transmitting number of the telephonic device with the transmitting number of the operator device stored in association with the virtual number in the mapping table.

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10. The method of claim 1, further comprising: provisioning the virtual number with the provider based on desired number information on the PSTN received for the virtual number; receiving mapping information for the virtual number, the mapping information including the transmitting number corresponding to the operator device; and storing the virtual number in the mapping table as a receiving number in association with the transmitting number corresponding to the operator device.
11. The method of claim 1, further comprising: in response to the mapping table identifying the telephonic device requesting to connect to the virtual number as the contact device, transmitting instructions for continuing to play the specified ring tone to the contact device until the first connection between the contact device and the operator device is established.
12. The method of claim 1, wherein the specified ring tone spoofs the physical location of the operator device.
13. A system comprising:
- 20 a server comprising one or more processors and a non-transitory computer-readable storage medium storing computer program code, the computer program code when executed performing steps comprising:
 - 25 configuring a virtual number with a provider of the virtual number, the virtual number configured with number information operable on a public switched telephone network (PSTN) and to playback a specified ring tone to telephonic devices requesting to connect to the virtual number, the virtual number associated with a transmitting number on the PSTN corresponding to an operator device in a mapping table and the specified ring tone spoofing the location of the operator device;
 - 30 receiving information in response to a request from a telephonic device to connect to the virtual number associated with the operator device, the information including a transmitting number on the PSTN corresponding to the telephonic device and the virtual number, the telephonic device receiving audio corresponding to the specified ring tone spoofing the location of the operator device;
 - 35 automatically identifying the telephonic device as the operator device or a contact device based on a comparison of the transmitting number on the PSTN of the telephonic device with the transmitting number on the PSTN of the operator device stored in association with the virtual number in the mapping table;
 - 40 in response to identifying the telephonic device as the contact device or the operator device, transmitting instructions for establishing a first connection between the contact device and the operator device through the virtual number for transmitting audio;
 - 45 automatically identifying a transmitting number on the PSTN of a monitoring device stored in association with the virtual number in the mapping table; and
 - 50 automatically transmitting instructions for establishing a second connection with the monitoring device responsive to the identified transmitting number on the PSTN of the monitoring device, the second connection configured to:
 - 55 permit the monitoring device to receive audio communications between the contact device and the operator device on the first connection; and
 - 60 prevent the contact device and the operator device from receiving audio associated with the second connection, the audio associated with the second

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connection comprising audio from establishing the second connection with the monitoring device and audio received on the second connection from the monitoring device for a duration of the second connection.

14. The system of claim 13, further comprising:

a second server comprising one or more processors and a computer-readable storage medium storing computer program code, the computer program code when executed performing steps comprising:

identifying connection requests from telephonic devices to the virtual number;

receiving instructions for dialing out to telephonic devices;

establishing connection between the contact device and the operator device; and

recording audio received from the contact device and the operator device.

15. The system of claim 13, wherein identifying the telephonic device as the contact device comprises transmitting instructions for connecting the contact device with the operator device associated with the virtual number to establish the first connection.

16. The system of claim 13, wherein identifying the telephonic device as the operator device comprises receiving information including a transmitting number on the PSTN corresponding to a contact device from the operator device and transmitting instructions for connecting the operator device with the contact device through the virtual number to establish the first connection.

17. The system of claim 13, wherein the instructions establishing the second connection permitting the monitoring device to receive audio communications include instructions for connecting the monitoring device with a second virtual number and passing audio communications between the operator device and contact device to the second virtual number.

18. The system of claim 13, wherein the instructions establishing the second connection permitting the monitoring device to receive audio communications include instructions for connecting the monitoring device with the virtual number and passing audio communications between the operator device and contact device to the second virtual number.

19. The system of claim 13, further comprising:

in response to the mapping table identifying the telephonic device requesting to connect to the virtual number as the contact device, transmitting instructions

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for continuing to play the specified ring tone to the contact device until the first connection between the contact device and the operator device is established.

20. The system of claim 13, wherein the specified ring tone spoofs the physical location of the operator device.

21. A computer based method comprising:

configuring a virtual number with a provider of the virtual number, the virtual number configured with number information operable on a public switched telephone network (PSTN) and to playback a specified ring tone to telephonic devices requesting to connect to the virtual number, the virtual number associated with a transmitting number on the PSTN corresponding to an operator device in a mapping table and the specified ring tone spoofing the location of the operator device;

receiving information in response to a request from a telephonic device to connect to the virtual number, the information including a transmitting number on the PSTN corresponding to the telephonic device and the virtual number, the telephonic device receiving audio corresponding to the specified ring tone spoofing the location of the operator device;

identifying the telephonic device as the operator device or a contact device based on a comparison of the transmitting number on the PSTN of the telephonic device with the transmitting number on the PSTN of the operator device stored in association with the virtual number in the mapping table; and

in response to identifying the telephonic device as the contact device, transmitting first instructions for establishing a first connection between the contact device and the virtual number and transmitting second instructions for establishing a second connection between the operator device and the virtual number, the first instructions causing the specified ring tone to continue playing for the contact device until the second connection between the operator device and the virtual number is established.

22. The method of claim 1, wherein audio from establishing the second connection with the monitoring device comprises tones associated with dialing the monitor device.

23. The system of claim 13, wherein audio from establishing the second connection with the monitoring device comprises tones associated with dialing the monitor device.

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